Part 121—Operating Requirements: Domestic, Flag, and Supplemental Operations

This change incorporates Amendment 121–266, Revisions to Digital Flight Data Recorder Rules, adopted July 9 and effective August 18, 1997. This amendment revises § 121.344 and adds § 121.344a and Appendix M.

Bold brackets appear around the revised or added material. The amendment number and effective date of these changes appear in bold brackets at the end of each affected section.

Page Control Chart

Remove Pages	Dated	Insert Pages	Dated
P–1367	Ch. 18	P–1367 through P–1391	Ch. 19
Subpart K	Ch. 17	Subpart K	Ch. 19
		Appendix M	Ch. 19

Suggest filing this transmittal at the beginning of the FAR. It will provide a method for determining that all changes have been received as listed in the current edition of AC 00–44, Status of Federal Aviation Regulations, and a check for determining if the FAR contains the proper pages.

policy to comply with ICAO Standards and Recommended Practices (SARP) to the maximum extent practicable. In reviewing the SARP for air carrier operations and JAR–OPS 1, the FAA finds that there is not a comparable rule under either ICAO standards or the JAR.

Regulatory Flexibility Determination

Congress enacted the Regulatory Flexibility Act (RFA) of 1980 (Pub. L. 96–354) to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires agencies to review rules that may have a significant impact on a substantial number of small entities. This amendment will impose no additional costs on air carriers; therefore, it will not have a significant economic impact on small business entities.

Federalism Implications

The regulations contained herein will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this amendment will not have sufficient implications to warrant the preparation of a Federalism Assessment.

Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this regulation is not a significant rulemaking action under Executive Order 12866. This amendment is also considered nonsignificant under Department of Transportation Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). In addition, the FAA certifies that this amendment will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the RFA.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends parts 121, 125, and 135 of the Federal Aviation Regulations (14 CFR parts 121, 125, and 135) effective June 20, 1997.

The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901, 44903–44904, 44912, 46105.

Amendment 121–266

Revisions to Digital Flight Data Recorder Rules

Adopted: July 9, 1997 **Effective: August 18, 1997**

(Published in 62 FR 38362, July 17, 1997)

SUMMARY: This document revises and updates the Federal Aviation Regulations to require that certain airplanes be equipped to accommodate additional digital flight data recorder (DFDR) parameters. These revisions follow a series of safety recommendations issued by the National Transportation Safety Board (NTSB), and the Federal Aviation Administration's (FAA) decision that the DFDR rules should be revised to upgrade recorder capabilities in most transport airplanes. These revisions will require additional information to be collected to enable more thorough accident or incident investigation and to enable industry to predict certain trends and make necessary modifications before an accident or incident occurs.

DATES: *Effective date:* August 18, 1997. Comments on the Paperwork Reduction Act issues presented in this document must be received by September 15, 1997.

ton, DC 20591; telephone (202) 267–3714.

SUPPLEMENTARY INFORMATION:

Background

Statement of the Problem

The NTSB submitted recommendations to the FAA to require the recordation of additional parameters on certain fight data recorders. These recommendations were submitted in response to accidents involving two Boeing 737 aircraft that were operated by two different air carriers. Both airplanes were equipped with flight data recorders (FDR's), but in neither case did the FDR provide sufficient information about airplane motion and flight control surface positions during the accident sequence to enable the NTSB to determine a probable cause for either accident.

The history of aircraft accidents and the lack of information that has inhibited proper investigation of their causes is much broader than recent experience with the Boeing 737. Historical records of airplane incidents suggest that additional, reliable data for the entire fleet of transport category airplanes is necessary to identify causes of these incidents before accidents occur. This rule will expand the data collection requirements to include all parameters that can cost-effectively be collected.

History of This Regulatory Action

NTSB Recommendations

On February 22, 1995, the NTSB submitted to the FAA recommendations A–95–25, A–95–26, and A–95–27, which recommended that the FAA require upgrades of the flight data recorders installed on certain airplanes to record certain additional parameters not required by the current regulations.

The following recommendations were submitted by the NTSB to the Federal Aviation Administration:

I. Require that each Boeing 737 airplane operated under 14 CFR part 121 or 125 be equipped, by December 31, 1995, with a flight data recorder system that records, as a minimum, the parameters required by current regulations applicable to that airplane plus the following parameters: lateral acceleration, flight control inputs for pitch, roll, and yaw, and primary flight control surface positions for pitch, roll, and yaw. (Classified as Class I, Urgent Action) (Recommendation No. A–95–25)

II. Amend, by December 31, 1995, 14 CFR §§ 121.343, 125.225, and 135.152 to require that Boeing 727 airplanes, Lockheed L–1011 airplanes, and all transport category airplanes operated under 14 CFR parts 121, 125, or 135 whose type certificates apply to airplanes still in production, be equipped to record on a flight data recorder system, as a minimum, the parameters listed in ''Proposed Minimum FDR Parameter Requirements for Airplanes in Service'' plus any other parameters required by current regulations applicable to each individual airplane. Specify that the airplanes be so equipped by January 1, 1998, or by the later date when they meet Stage 3 noise requirements but, regardless of Stage 3 compliance status, no later than December 31, 1999. (Classified as Class II, Priority Action) (Recommendation No. A–95–26)

III. Amend, by December 31, 1995, 14 CFR 121.343, 125.225, and 135.152 to require that all airplanes operated under 14 CFR parts 121, 125, or 135, having 10 or more seats, and for which an original airworthiness certificate is received after December 31, 1996, record the parameters listed in ''Proposed FDR Enhancements for Newly Manufactured Airplanes'' on a flight data recorder having at least a 25-hour recording capacity. (Classified as Class II, Priority Action) (Recommendation No. A–95–27).

FAA Response to the NTSB Recommendations

On March 14, 1995, the FAA published in the *Federal Register* a notice of a public hearing, and solicited public comment concerning the NTSB recommendations. On April 20, 1995, the public

that include, as a minimum, the parameters referenced in this safety recommendation. This proposed rule would require all Boeing 737 airplanes as well as certain other airplanes operated under 14 CFR parts 121, 125, or 135 having 10 or more seats to be equipped to record the parameters that were specified by the NTSB.

The FAA received enough valid information from the public to determine that the schedule for retrofit completion by December 31, 1995, could not be met. The proposed date would have imposed an extremely aggressive retrofit schedule that, if it were physically possible, would have resulted in substantial airplane groundings and very high associated costs. Furthermore, if operators had been required to retrofit all Boeing 737 airplanes before the end of 1995, each of these airplanes might have had to undergo a second retrofit to meet the expanded requirements that were proposed in response to NTSB Recommendations A–95–26 and –27.

In response to NTSB recommendation A–95–26, the FAA agrees that airplanes still in production should be required to be equipped with DFDR's that record, as a minimum, the parameters listed in the NTSB recommendation.

In response to NTSB recommendation A–95–27, the FAA agrees that airplanes operated under parts 121, 125, or 135 having 10 or more seats for which an original airworthiness certificate is received after December 31, 1996, should record the parameters listed in "Proposed FDR Enhancements for Newly Manufactured Airplanes" on a flight data recorder having at least a 25-hour recording capacity.

Aviation Rulemaking Advisory Committee Participation

After reviewing the comments submitted pursuant to the NTSB recommendations and listening to the presentations, the FAA determined that it would be beneficial to have aviation industry personnel assist in any related rulemaking efforts. On June 27, 1995, the FAA published a notice in the *Federal Register* that the Aviation Rulemaking Advisory Committee (ARAC) established the Flight Data Recorder Working Group (60 FR 33247), which included members representing the Air Transport Association, Aerospace Industries Association of America, General Aviation Manufacturers Association, Regional Airline Association, Air Line Pilots Association, and the FAA. The NTSB was invited to participate in working group efforts in an advisory capacity. The working group's task was to recommend to ARAC rulemaking proposals or other alternatives that would satisfactorily address the NTSB recommendations. The ARAC could then make one or more recommendations to the FAA, and the FAA would determine whether to issue a proposal based on the ARAC recommendation.

The DFDR Working Group met over the course of several months. While many of the issues concerning flight data recorder upgrades were settled, no formal recommendation was forwarded to the FAA by the ARAC. A full discussion of the issues considered by the working group was included in Notice 96–7.

NPRM No. 96–7

On July 16, 1996, the FAA published an NPRM addressing revisions to digital flight data recorder rules and solicited public comment to the proposed amendments. The proposals were based on meetings attended by FAA, ARAC, and NTSB personnel. Twenty-six commenters responded, each addressing multiple issues. Their comments have been placed in the docket. Although numbered comments in the docket indicate 28 commenters responded, several submittals were duplicates. Comments to the NPRM are discussed in detail in the "Discussion of Comments to the NPRM" section of this document.

Supplemental Notice of Proposed Rulemaking, SNPRM No. 96–7A

As a result of some comments received and further analysis within the FAA, the FAA determined that some issues not included in the NPRM, but related to the proposal, should have been included. These issues included: (1) Applicability of the requirements to airplanes placed on the operations specifications of a U.S. operator after a certain date; (2) a compliance date for certain aircraft that must be retrofitted with DFDR equipment as a result of a change in policy announced in Notice 96–7; (3) information regarding airplanes that should be exempted from the requirements proposed in Notice 96–7; and (4)

Flight Systems Engineering, Inc., comments on the requirement for recordation of lateral acceleration on airplanes with one or two engines. It states that to the best of its knowledge, the ''trade-in'' program to upgrade from dual to tri-axial accelerometers was considered, but is not currently available and it doubts it will ever be. The commenter estimates the cost of the tri-axial accelerometer to be $3,000 per aircraft plus associated engineering and installation costs. The commenter believes that the accelerometer information can be obtained through analysis of other available data. In addition, the commenter states that to require a sampling rate of twice per second (rather than the current once per second) as proposed for certain parameters may generate costs to industry that the commenter does not consider to be cost beneficial.

FAA Response: The FAA acknowledges that this rule will place some economic burdens on operators. According to information received by the FAA, however, the $3,000 per aircraft for a tri-axial accelerometer is a maximum cost for a new unit, which, in practice, the FAA maintains will not be installed in all cases. Rather, modified units will be used wherever possible. The FAA does not agree that the commenter's proposed method of obtaining the information through analysis is a reasonable alternative that would satisfy the NTSB recommendation. No changes have been made as a result of this comment.

Patriot Sensors and Controls Corporation (Patriot) comments that it would cost approximately $2000 in 1997/1998 dollars to upgrade the lateral acceleration sensor from a dual axis to a tri-axial configuration. Patriot emphasizes that to accomplish the upgrade in a timely manner, upgrades of its units should be scheduled as soon as possible after issuance of the final rule. It emphasizes that it can not guarantee timely accomplishment for any order received later than 18 months prior to the final date of compliance.

FAA Response: The FAA appreciates the comment from Patriot; the FAA notes that the costs for modification of existing units presented by the commenter are approximately one third less than those presented by the operators for new units. Further discussion of other comments concerning the economic impact of this rule are contained in the Regulatory Evaluation section of this preamble.

AVRO International Aerospace comments that the proposed list of parameters appears to have been developed to address a specific type of airplane that has experienced a small number of accidents, and that the proposed list of parameters may not be the most appropriate for general application. AVRO also states that the European codes have been formalized for adoption through JAR Ops and that it considers the FAA's action to extend requirements beyond the EUROCAE ED–55 standards (ED–55) without a full consultation with JAA authorities to be contrary to the spirit of the JAR/FAR Harmonization program.

FAA Response: The FAA acknowledges that the requirements proposed in the NPRM could appear to have been developed to address a specific type of airplane, and expanded to merely include all airplanes. However, the parameters proposed to be recorded involve functions of all airplanes, and may provide data over a wide range of incidents and accidents. Accordingly, in response to the NTSB recommendation, the FAA has included all transport category airplanes in this rulemaking action. The FAA disagrees that extended U.S. requirements require full consultation with JAA authorities. The ARAC working group considered current international standards where they exist, and realized that restricting the upgrades to ED–55 standards would not satisfy the NTSB recommendation. The standards proposed are harmonized with the current JAR-Ops, which are based on the ED–55 standards; the additional U.S. requirements have no JAR counterpart with which to harmonize. No changes were made as a result of this comment.

Aerospace Industries Association (AIA) submits technical comments and editorial comments regarding typographical errors. For parameter 88, all cockpit flight control input forces (control wheel, control column, rudder pedal), AIA comments that the force sensor accuracy in the appendix should be changed from ''+/−5%'' to ''+/−5% or +/−15% of actual, whichever is greater or as installed.'' AIA also comments that the accuracy values in the appendix for the Force Sensor Range for Wheel, Column, and Pedal ranges of parameter 88 should be changed to include the words ''or as installed'' after the numerical values. Also for parameter 88, AIA suggests the following language be added to the remarks column: ''Force Sensor Range requirements are based on FAR 25.143(c).'' Finally, AIA suggests that

The FAA agrees that the Force Sensor requirements for parameter 88 should be moved from the Accuracy column to the Range column in the appendices; the change is reflected in this final rule.

AIA also commented that the following should be added to the Remarks column in the appendices for parameters 82, Cockpit trim control input position—pitch, 83, Cockpit trim control input position—roll, and 84, Cockpit trim control input position—yaw: "Where mechanical means for control inputs are not available, Cockpit Display Trim Positions should be recorded." Its rationale for the change is that modern transport aircraft do not always use mechanical trim controls.

FAA Response: The FAA concurs and the language in the Remarks column in the appendices for parameters 82, 83, and 84 has been revised.

Finally, AIA comments that the language in the Remarks column in the appendices for parameter 32, Angle of attack (if measured directly), is incomplete and should be changed to read as follows: "If left and right sensors are available, each may be recorded at 4 or 1 second intervals as appropriate so as to give a data point at 2 seconds or 0.5 seconds as required."

FAA Response: The FAA concurs and the language in the Remarks column in the appendices for parameter 32 has been changed. Also, all typographical errors noted in AIA's comments have been corrected in this final rule.

Embraer comments on the technical aspects of several proposed items; the commenter states that airplanes fitted with conventional mechanical flight controls should be allowed to record either the flight control input or the control surface position. The commenter further states that derived information for control input and control movement can be demonstrated for its aircraft. Embraer also comments that due to technical constraints such as sensor reliability, low level signal treatment, and aircraft installation, plus cost restraints and the low priority given to cockpit flight controls forces (as evidenced by their location in the order of the parameter list), it considers the recording of these parameters unnecessary. Embraer also comments that to be able to accommodate 88 parameters, it will be necessary to replace existing recorders that record 64 to 128 words per second (wps) with a new one capable of recording 256 wps, which is not presently available on the market. Embraer also submits cost figures for updating its software and hardware.

FAA Response: The NTSB recommendations on which this rulemaking action is based indicate that both control input and surface position are necessary for both conventional mechanical flight controls and fly-by wire controls. Past accident investigations support the need for this data. Further, although the NTSB has used derived information in support of some findings in accident investigation, the NTSB has noted that derived information may include too many variables to support the determination of probable cause of an accident.

The FAA acknowledges that some technical constraints regarding force sensors may currently exist. The recordation of the associated parameter, however, is not required until 5 years from the effective date of the final rule, and the FAA anticipates that within the next 5 years, these technical constraints will be overcome. Also, with regard to the ability to record 256 wps, the FAA maintains that there are recorders available today that include this technology, and expects them to be more readily available within 5 years, when newly manufactured airplanes must have recorders capable of recording all 88 parameters.

The FAA acknowledges that the DFDR enhancements proposed by this rule are expensive and that a recognized safety return may not immediately be recognized. However, the FAA maintains that the information collected will aid in accident and incident investigations and will help detect trends so that corrective measures can be taken before an accident occurs, and that collection of this data is in the public interest.

The FAA notes that the additional cost information submitted by Embraer is consistent with information submitted by ARAC working group members during development of the NPRM. Further discussion of other comments concerning economic issues can be found in this preamble under the section "Regulatory Evaluation." No changes were made to the proposal as a result of Embraer's comment.

rule reflects the change in the resolution column of the appendices for parameters 5, 11, and 18 to read 0.004g's.

Aerospatiale and Alenia (ATR), manufacturers of ATR airplanes, comment that compliance with the primary flight control and master warning recording requirements would involve significant software modification and hardware modification of the flight data acquisition units (FDAU's), plus additional wiring. The two manufacturers state that the design changes would cost $100,000 per aircraft for U.S. operators for parts and labor, in addition to down time associated with completing the modifications. ATR requests that some flexibility be introduced into the requirements that would take into account certain design features such as flight control characteristics or aircraft weight. In addition, ATR states that harmonization with the EUROCAE ED–55 requirements should be considered for the retrofit requirements.

FAA Response: The FAA acknowledges that there may be alternatives to obtaining data other than direct recordation. However, the proposed sampling rates, resolution readouts, and parameter list in the NPRM represent contributions from all members of the ARAC working group. The ARAC working group made every effort to match the requirements in the proposal to both the requirements in ED–55 and the NTSB recommendations, and the FAA has determined that the differences are insignificant for U.S. operators. No changes were made as a result of this comment.

Airbus Industrie agrees with the statement in the preamble of Notice 96–7 that more flight data yields better results when investigative authorities are trying to determine the cause of an accident or incident. It suggests, however, that requirements for recording stick shaker/stick pusher, yaw or sideslip angle, and hydraulic pressure are not necessary because the information can be derived from other data, or because the information is not relevant to the understanding of system operation. Airbus Industrie also suggests that the rule should retain the current language that would allow the proposed terms ''record'' and ''recorded'' to be replaced respectively with the terms ''determine'' and ''able to be determined.'' In addition, Airbus Industrie comments that it has always installed advanced recording systems on its aircraft, but that aircraft already equipped to record 88 or more parameters may not be recording all of those proposed in the NPRM. Airbus Industrie suggests that the FAA require recordation of only those parameters included in EUROCAE ED–55, and states that anything else would constitute disharmony with European regulations. The commenter does not oppose the recordation of additional data, but would like to see more international involvement to determine what additional data should be included, and suggests that the effort be addressed within the ICAO and within the FAA/JAA Harmonization Work Program under the ARAC process before additional parameters beyond ED–55 are added.

Airbus Industrie also suggests that proposed §§ 121.344 and 125.226 be revised so that current FDR's that already record the necessary parameters, but not at the specific sampling or resolution readouts listed in Appendix K (corrected to read Appendix M), not be required to incur retrofit costs simply to meet those Appendix M values. Airbus Industrie believes that the introduction of this flexibility would result in significant cost savings to industry without jeopardizing the capability of investigating events.

FAA Response: The FAA acknowledges that there may be alternatives to obtain data other than direct recordation. However, the proposed sampling rates, resolution readouts, and parameter list in the NPRM represent contributions from industry representatives, the FAA, and the NTSB. During ARAC working group meetings, the NTSB argued that information gathered from interpretation was not as reliable as direct recordations, as discussed above. Some industry representatives did not agree. After further discussion, the working group decided that, to respond to the NTSB recommendations on which this rulemaking is based, the rule would be written with a requirement for direct recordation of the parameters listed. Although Airbus Industrie presents an alternative to obtaining information directly from a flight data recorder, the FAA has determined that justification provided by Airbus Industrie is not sufficient to overcome the NTSB's arguments that information gathered from interpretation is not as reliable as direct recordation. Accordingly, there was no change to the proposal as a result of this comment.

As previously stated, the FAA disagrees that international disharmony occurs as a result of this final rule. The ARAC working group made every effort to make the proposal identical, where applicable, to the requirements of ED–55. However, the FAA has determined that those requirements alone are

(additional) parameter. Fairchild states that compliance with current § 135.152 and implementation of the proposed § 121.344a(a) is more than adequate for the size and complexity of any airplane in the 10–19 seat category. It is the commenter's understanding that the goal of this rulemaking is to provide information regarding accidents and incidents as they occur, and it notes that 10–19 seat aircraft have no history of accidents of undetermined cause.

Fairchild believes that the money needed to comply with the proposed regulations could be better spent improving overall operations. It states that an FDR will not increase the level of safety in the 19-seat airplane, and will probably diminish the level of safety, because funds will be diverted to comply with something of no value versus something of positive value. Fairchild also states that, if adopted, the proposal would have a significant negative impact on the competitiveness of current operators and airplanes made in the United States that are sold on the international market. Fairchild believes the proposed changes would increase operating costs and thus negatively affect future sales in both the United States and foreign markets, particularly to customers in developing nations. Finally, Fairchild submits some cost information, as well as the following technical comments:

Fairchild recommends deletion of § 121.344a(b) and (c), which would require newly manufactured airplanes with 10 to 19 seats to install enhanced DFDR's. Fairchild also notes that in § 121.344a(a)(1)(iv), a typographical error occurs; the second reference to Appendix B should instead be a reference to Appendix M.

Fairchild points out that the FH227 listed in parts 121 and 125 does not belong to Fairchild Aircraft, Inc., as stated in the proposal.

Fairchild requests that the following airplane types be added to the list of airplanes that need not comply with the requirements in § 121.344a, but continue to comply with the requirements in § 135.152: SA227–AC, SA227–TT, SA227–AT, and SA227–BC. As justification, Fairchild submits that these airplanes were manufactured prior to October 11, 1991, and are not commuter category airplanes.

FAA Response: As stated in the NPRM, when the NTSB made its recommendations in February 1995, the FAA has not yet issued its rule that requires most airplanes that have 10–19 seats that were formerly operated under part 135 to operate pursuant to the requirements of part 121 beginning in March 1997. Because the purpose of that rulemaking action was to establish "one level of safety," the NPRM associated with this final rule, and all rules developed from this point forward, reflect that agency policy. Recognizing the differences between larger airplanes operating under part 121 and those designed to carry 10–19 passengers, the FAA developed a special section in the NPRM to specifically address the flight data recorder requirements for these airplanes. The ARAC working group discussed and decided that the intent of the NTSB recommendations was to capture all airplanes regularly used in commercial service, including those that began operating under part 121 beginning in March 1997.

The FAA disagrees with the suggestion to delete § 121.344a(b) and (c) for newly manufactured airplanes. The suggestion is inconsistent with the NTSB recommendations, and no alternative to satisfy the recommendation was suggested. No change was made as a result of this comment.

The FAA agrees that the second reference to Appendix B in § 121.344a(a)(1)(iv) is an error; "Appendix B" should read "Appendix M." The rule has been revised accordingly.

The FAA finds that insufficient information was submitted to justify the addition of the following planes to the list of airplanes that need not comply with the requirements in § 121.344a, but continue to comply with the requirements in § 135.152: SA227–AC, SA227.TT, SA227–AT, and SA227–BC. The fact that airplanes were manufactured before October 11, 1991, is not considered sufficient to justify their exclusion. No change was made as a result of this comment.

The FAA agrees that the FH227 does not belong to Fairchild Aircraft, Inc., and the final rule has been revised to reflect the aircraft is a product of Fairchild Industries.

All typographical errors noted by the commenter have been corrected in this final rule.

preamble to the NPRM. In that document, the FAA stated that "heavy maintenance check" provision was added to prevent operators from waiting until the last minute to install upgrades, causing a logjam in scheduling and equipment availability. The proposed sampling rates reflect those needed by the NTSB to aid in accident and incident investigations. No changes were made as a result of this comment.

Airborne Express comments that lateral acceleration cannot be recorded at the specified recording intervals using the Loral F800 flight data recorder. Airborne Express states that 70% of its fleet is fitted with the Loral F800, and to replace these recorders would constitute an undue burden. The commenter suggests that language be changed to reflect that, except for the Boeing 737, lateral acceleration should not be required to be recorded unless sufficient capacity is available on the existing recorder to record that parameter and that the recording ranges, accuracies, and recording intervals be limited to those specified in current Appendix B to part 121. In addition, Airborne Express asks for clarification of the term "capacity" as it is used in proposed § 121.344(b)(1)(i) so it can determine whether it can comply with the proposed rule language.

FAA Response: According to Loral, the manufacturer of the F800 recorder, lateral acceleration can be recorded for the Airborne Express installation if a nonrequired parameter is removed from the input to the recorder, and the existing spare channels are used. The term "capacity" refers to the design of a recorder to be able to record a certain number of parameters and store them for 25 hours. For example, a recorder may have a capacity to record 32 wps for 25 hours, 64 wps for 25 hours, 128 wps for 25 hours, etc. No changes to the rule were made as a result of this comment.

Piedmont Airlines (Piedmont) comments that although it agrees with the NTSB in the importance of information retrieved from FDR's, it believes "the one size fits all" approach to rulemaking is not an efficient or cost effective method. Piedmont believes the primary reason for the rule is two unresolved accidents that were due to loss of control. However, they do not agree that those accidents justify the proposal to obtain directly recorded data as opposed to obtaining information through alternative methods. Piedmont submits examples of two airplanes that will have to undergo some retrofit to comply with the rule as proposed. Piedmont believes that those airplanes are clear examples that existing recorded data is adequate for accident prevention and investigation, and that the proposed requirement will result in a costly retrofit for the purpose of a data-gathering exercise that is not justified by any benefit/cost comparison. Piedmont believes it would be cost beneficial to require recording up to 17 parameters but it disagrees that, other than for powered flight controls, both the control surface and the input need be recorded.

FAA Response: The FAA realizes that this rulemaking action may appear to be intended for certain airplanes that have been involved in accidents, the cause of which has not been determined. As stated in the NPRM, the FAA has determined that since the cause of these accidents is unknown, it is possible that similar incidents may occur on other airplane types. Therefore, the FAA finds that the need to record additional flight data is applicable to all airplanes covered by the final rule. The FAA recognizes that DFDR's do not in and of themselves prevent accidents; they are used as an investigative tool when accidents or incidents occur. However, the FAA does not agree that continuing the current level of data collection is acceptable for future accident investigation. The FAA recognized in the NPRM that additional flight data can be collected cost-effectively, particularly in light of the NTSB recommendations. No changes were made as a result of these comments.

Twin Otter International, Ltd. (TOIL) and its affiliate by ownership, Grand Canyon Airlines, Inc. (GCA) comments that its members use deHavilland DHC–6–300 airplanes in their operations. This airplane type went out of production before October 11, 1991. TOIL claims that the DHC–6–300 was not designed to accommodate flight data recorders, and that installation would require extensive redesign and would be prohibitively expensive. In addition, the manufacturer is not interested in participating in the cost of certifying and retrofitting the airplanes for flight data recorder installation and no other airworthiness authority worldwide requires a DFDR in the DHC–6–300. TOIL states that no DHC–6–300 has ever been equipped with a DFDR.

The commenter states that the reversal of the policy determination addressed in Notice 96–7 would create a regulatory inconsistency because 12 of its DHC–6–300 airplanes would be required to be retrofitted,

(Twin Otter) should be exempted from the flight data recorder upgrade requirements proposed in the NPRM, and the final rule includes an exemption for the DHC–6, whether the airplanes are operated under part 121 or part 135.

The FAA fully considered the popularity of this aircraft model in the sightseeing industry, and determined that the exemption is still appropriate. The FAA does not agree with TOIL's characterization of the effect of the policy change announced in Notice 96–7, nor that the policy announced in Flight Standards Information Bulletin 92–09 should be codified. The revised policy states that airplanes previously registered in the United States that were removed and brought back on the register after October 11, 1991 are not ''grandfathered'' and must install flight data recorders. This interpretation is consistent with both the language and the intent of the current rule. While the FAA acknowledges that the October 11, 1991 date creates two classes of airplanes that are otherwise the same, any other method of distinguishing airplanes that must be retrofitted would have an equally bifurcated effect. TOIL's proposed solution to use October 11, 1991 as a date of *manufacture* to distinguish those airplanes to be retrofitted is a solution only for aircraft out of production; airplanes in production would continue to be separated into two classes by the date regardless of how identical two airplanes were when they came off the production line. The 1991 ''brought on the U.S. register'' date was adopted in 1988, and a well-defined class of airplanes was established. The FAA has no reason to now disrupt the applicability of the flight data recorder requirements by changing from one date to another when it would not solve the problem described by the commenter. Nor does the FAA agree with the commenter that, as a class, airplanes that are no longer being produced should be categorically exempted from the DFDR requirements.

In a comment to the NPRM, Twin Otter International, Ltd. (TOIL) comments that two classes of airplanes are created by the ''brought on the U.S. register'' language because foreign registered airplanes may be operated in the United States. This issue was raised by the FAA in the SNPRM to this rule, and the agency proposed that the applicability of the regulation be changed to include airplanes brought onto the U.S. register *or* airplanes that are foreign registered and added to an operator's U.S. operations specification after October 11, 1991. As explained in the preamble to the SNPRM, the original language was adopted to minimize costs and to deter the importation of older, non-DFDR equipped airplanes. The fact that the language created a separate standard for non-U.S. registered airplanes was unintentional; the FAA always intended to cover all of the airplanes operating domestically. TOIL did not comment on the change proposed in the SNPRM. Based on the comment of TOIL, the final rule language includes an exemption for the Twin Otter. No other changes were made based on this comment.

The Regional Airlines Association (RAA) comments that it supports the enhancement of FDR recording parameters where the benefits can be shown to justify the costs, and suggests that the compliance period be extended to 6 years. RAA supports the proposed rule as it applies to newly manufactured aircraft. However, RAA states that many of the proposed requirements to retrofit new recording parameters into existing airplanes have not been shown to provide a direct safety improvement or to be cost effective, and that requiring installation will impose a severe economic burden on affected operators, resulting in increased costs of travel to the public, and thus should be eliminated.

FAA Response: The FAA recognizes that the DFDR enhancements proposed by this rule may be costly and may not provide immediately recognized benefits. However, cost alone cannot justify ignoring the potential safety gain represented by the improvements required by this rule. The FAA has determined that this final rule should be promulgated as in the public interest, and RAA has not submitted sufficient justification to show that it is not in the public interest. No changes were made as a result of this comment.

The Air Line Pilots Association (ALPA) agrees with the proposal except for the proposed compliance period, and suggests that the FAA contact FDR and FDAU manufacturers directly to validate the economic information supplied in the NPRM. The commenter believes that the four year compliance period outlined in the proposed rule for the retrofit of FDR's is too long, and that three years is more appropriate.

FAA Response: The FAA relied heavily on the industry members of the ARAC working group to supply accurate economic information, including costs of parts, labor, and aircraft down time. The information was provided in aggregate form based on major cost components, not in detail. Therefore,

effective date of the final rule. No changes were made as a result of this comment.

General Aviation Manufacturers Association (GAMA) comments that the FAA has gone beyond the scope of the NTSB recommendations by including 10 to 19 passenger airplanes in the NPRM. GAMA also states that it considers the requirements proposed not to be cost beneficial, and thus a final rule should not be published. GAMA indicates that requiring enhanced DFDR's would not support the theory of eventual zero unexplained accidents per year simply by increasing the number of parameters being monitored. The commenter states that a regulatory analysis is not provided for newly manufactured airplanes and feels this is necessary by law and is essential. GAMA also disagrees with the FAA's conclusion that the cost of developing a 256 word per second recorder is insignificant. It cites the requirement to develop standards through committees, and the issue of possible import design and data correlation as additional cost burdens. GAMA comments that the FAA highlights the benefits of the NPRM and downplays costs, and that the proposal does not adequately quantify the benefits. The FAA should be required to conduct a full and complete cost analysis of the total NPRM impact prior to issuing a final rule. GAMA further maintains that although the FAA states that no disharmony is created in the proposal, it disagrees, and lists areas of possible conflict as parameters 40, 41, 42, and 44.

GAMA also comments that the NPRM should include rule language that would exclude retrofit requirements for existing airplanes operated under part 135 for on-demand service, and would exclude those newly manufactured airplanes to be operated under part 135 for on-demand service. Likewise, the commenter states that the proposed amendments should include language that the amendments would not apply to any airplane type certificated for nine or fewer passenger seats or any rotorcraft.

GAMA also comments that several of the parameters' names or corresponding remarks are ambiguous and need to be further clarified. It further comments that the rule language should be changed to include in the rule text the appendix remarks concerning flight control breakaway capability; suggests that the dual coverage requirement for conventional axes be deleted; and suggests that the requirement for recordation apply to only aircraft axes that are augmented.

For newly manufactured airplanes, GAMA believes there are differences between parameters that some operators have chosen to record and proposed parameters 58–88. GAMA asks whether operators must cease recording parameters of choice or those required in the JAR-Ops and/or ED–55, and instead record the proposed extended parameters. GAMA believes clarification is needed regarding these issues.

FAA Response: As explained in the NPRM, when the NTSB made its recommendations in February 1995, the FAA had not yet issued its rule that requires most airplanes that have 10–19 seats that formerly operated under part 135 to comply with the requirements of part 121 beginning in March 1997. Because the purpose of that rulemaking action was to establish ''one level of safety,'' the NPRM associated with this final rule, and all rules developed from this point forward, reflect that agency policy. Recognizing the differences between larger airplanes operating under part 121 and those designed to carry 10–19 passengers, the FAA developed a special section in the NPRM to specifically address the flight data recorder requirements for these airplanes. The ARAC working group discussed and decided that the intent of the NTSB recommendations was to capture all airplanes regularly used in commercial service, including those 10–19 seat airplanes that began operating under part 121 in March 1997.

The FAA recognizes that increasing the number of recorded parameters may not realize an immediate safety return, but maintains that the information collected will aid in accident and incident investigations, and will help detect trends so corrective measures can be taken before an accident occurs. The FAA also maintains that as more information is recorded, the occurrence of unexplained accidents and incidents will decrease.

Regarding the commenters statements addressing the cost/benefit analysis, an analysis for newly manufactured airplanes, costs associated with developing a 256 word per second recorder, and other cost burdens: these and other comments concerning economic impact are discussed further in the Regulatory Evaluation section of this preamble.

The FAA disagrees that disharmony is created in the proposal, and notes that harmonization does not mean identicality. The final rule is as similar as practicable with international standards, where they

the FAA finds that all airplanes affected should comply with the new regulations, regardless of the nature of their operation. The FAA disagrees with the commenter's suggestion that language be added to exclude airplanes certificated for nine or fewer passenger seats and all rotorcraft. Section 135.152 does not apply to airplanes with nine or fewer passenger seats, and the proposed language in § 135.152(f) applies only to airplanes that would be required to be equipped in accordance with §§ 135.152(a) or (b), as appropriate.

With respect to the commenter that some of the parameter name and corresponding remarks are ambiguous, the FAA notes that the names and remarks have evolved over time and are generally accepted by industry. The names and remarks were discussed during the ARAC working group meetings in which GAMA participated. No technical concerns over the names of the parameters were raised by the commenter at the time or subsequently by any other commenter. The nature of the commenter's questions concerning specific parameter names will be considered in preparation of the Advisory Circular already under development.

The FAA disagrees that the text contained in the appendix "Remarks" column should be incorporated into the rule language for flight control breakaway capability parameter. The FAA has determined that this addition would be confusing for a single parameter and that the text should remain in the "Remarks" column of the appendix.

The FAA disagrees that the dual coverage requirement for conventional axes should be deleted and that the requirement for recordation should apply to only aircraft axes that are augmented. The FAA finds that both of these requirements are needed to meet the NTSB recommendations.

Regarding the issue of recording required parameters rather than recording parameters of choice (or those required in the JAR-Ops and/or ED–55), the final rule states the parameters that must be recorded in each appropriate section. An operator may choose to record parameters beyond those required, but must record the required parameters. The FAA acknowledges that some operators may have to change the parameters currently being recorded, unless an operator chooses to replace its equipment for that with greater capacity.

The National Air Transportation Association (NATA) comments that proposed § 135.152 should be revised in the final rule to differentiate the applicability of the new requirements by "kind of operation" in which a 10 to 30 seat airplane is used. It also comments that the final rule language should be clarified concerning its applicability to 10 to 30 seat airplanes used in part 135 on-demand operations. The FAA is unable to understand clearly NATA's comment regarding proposed regulations for airplanes brought onto the U.S. register on or before October 11, 1991. The FAA concludes that NATA is suggesting that affected commuter airplanes operated under § 121.344a that are brought onto the U.S. register after October 11, 1991, should be required to meet only existing part 135 requirements. NATA appears to believe that there is no justification in requiring two sets of regulations for the same airplane type simply because of registration date, and suggests that the October 11, 1991, date be deleted and that the date of manufacture be used instead. NATA agrees with the exclusion of rotorcraft and airplanes certificated with nine or fewer passenger seats from the regulations, but feels that the term "multiengine," which is included in current § 135.152(a) and (b), should be included in proposed §§ 135.152(i) and (j).

FAA Response: The FAA appreciates the NATA comment but it does not agree that applicability is an issue for this final rule. The FAA recently promulgated new part 119, which determines the type of operation that is applicable to an on-demand or commuter operation. When using the definitions of part 119, it is clear that § 135.152 applies to on-demand operators of the 10–30 seat airplanes, and that § 121.344a applies to scheduled commuter operators. The FAA acknowledges that DFDR's do not in and of themselves prevent accidents; they are used as an investigative tool when accidents or incidents occur. However, it does not agree that continuing to obtain the current level of information required to be recorded by § 135.152 without obtaining any new information is acceptable for future accident investigation. Similarly, the FAA does not agree with NATA that the term "multiengine" should be included in the new §§ 135.152(i) and (j) for certain newly manufactured airplanes. In its deliberations, the FAA decided that a new, single-engine, turbine-powered airplane capable of carrying 10 to 30 passengers

newer generation aircraft is not cost effective and recommends that several parameters be recorded at a sampling rate of once per second rather than twice per second as proposed. (The specific parameters will be addressed in the FAA reply.) In addition, ATA requests clarification regarding those aircraft that fall under the requirements of Appendix B and have the flight control breakaway capability that allows either pilot to operate the controls independently.

ATA comments that the Lockheed Aircraft Corporation Electra L–188 should be included on the list of airplanes that would not have to comply with the new proposal. The L–188 is out of production but remains in service. ATA also comments that the Loral 800 FDR does not have the capacity to record lateral acceleration at the rate of 4 words per second, as proposed. A two-engine airplane equipped with the Loral F800 is only capable of recording this parameter at a rate of 1 wps. ATA recommends that Appendix B be revised to allow a recording rate of 1 wps for lateral acceleration for airplanes equipped with 32 wps recorders.

Also, ATA comments that the NPRM does not take into account aircraft with specialized data acquisition systems that may be capable, for example, of recording primary axis controls, either by pilot inputs or by surface position, but is not capable of recording both. ATA maintains that software to support this unique system is not available, which would result in the need to install extensive rewiring and expensive hardware.

ATA also comments that some of the accuracies listed in the NPRM for certain parameter sources differ from the accuracy as defined by the aircraft manufacturer, and suggests that when this happens, the manufacturer's accuracy should apply over the affected range.

ATA comments that some operators have established their DFDR Maintenance Programs using the current Appendix B parameter numbers for tracking and compliance purposes. ATA recommends that the final rule allow those operators that have a parameter-number-based FDR maintenance program to add the new parameters (numbers) to the original list, their maintenance manuals, and word cards.

ATA states that the FAA's time frame for compliance is more reasonable than that proposed in the NTSB recommendations, but still maintains there will be a tremendous burden on manufacturers, operators, and suppliers, as well as the FAA. Although FAA rejected ATA's earlier recommendation to establish a phased compliance schedule, ATA now suggests the FAA should survey operators annually after the effective date of the rule to determine the status of operator retrofit programs.

ATA states that with a few exceptions, its cost estimates generally agree with the data presented by the FAA in the proposed rule. It states, however, that some costs were not addressed in the NPRM, and consequently, ATA feels the FAA's cost estimates underestimate the total program costs.

FAA Response: The FAA disagrees that disharmony occurs as a result of this final rule. The ARAC working group made every effort to make the proposal identical, where applicable, to the requirements of ED–55. However, the FAA has determined that those requirements are insufficient to satisfy NTSB recommendations for U.S. operators, and has thus provided some additional requirements. The FAA recognizes that there may be other alternatives to obtain data, but no comprehensive alternative that would meet the NTSB recommendations has been presented, nor cost data submitted for comparison. The proposed sampling rates, resolution readouts, and parameter list in the NPRM were developed with input from industry representatives, the FAA, and the NTSB. The FAA has determined that justification provided by ATA is not sufficient to change the proposal.

The FAA agrees that the Lockheed Aircraft Corporation Electra L–188 should be included in the list of airplanes that need not comply with these amendments, and the applicable sections have been revised in the final rule.

The FAA does not agree that the Loral F800 is incapable of recording 4 samples per second (the FAA assumes ATA misquoted the NPRM when it said 4 words per second), as proposed. According to the manufacturer of the F800 recorder, lateral acceleration can be recorded at 4 samples per second if a nonrequired parameter is removed from the input to the recorder, and the existing spare channels are used.

The FAA acknowledges that some of the accuracies listed are not the same as those listed by the manufacturers, but maintains that to achieve the minimum level of safety prescribed by the rule, and to maintain the continuity of recorded data, the FAA must establish the standards, not the individual manufacturers.

The comment concerning operator maintenance programs is not a flight data recorder issue, and is beyond the scope of this rulemaking action. The current rule does not prohibit, and the NPRM did not propose to prohibit those operators with a parameter-number-based FDR maintenance program from adding new parameters (by number) to the original list, their maintenance manuals, or word cards.

Regarding the commenter's suggestion to survey operators annually after the effective date of the rule to determine the status of operator retrofit programs, the FAA finds that the exercise would serve no useful purpose and would require additional resources and paperwork. Operators may submit their DFDR retrofit status at any time on a voluntary basis. During working group discussions, it was decided that a phased-in compliance schedule would not be necessary because affected airplanes could be retrofitted with any newly required equipment at the time of a heavy maintenance check. A separate DFDR retrofit schedule could conflict with other established maintenance schedules and increase costs.

Discussion of economic comments can be found in the Regulatory Evaluation section of this preamble. Except where noted above, no changes were made as a result of this comment.

The National Transportation Safety Board disagrees with the FAA's proposed compliance dates for newly manufactured and existing aircraft, and with the minimum parameter requirements for existing aircraft. It also disagrees with the FAA's decision not to require more expeditious flight control parameter upgrades for Boeing 737 airplanes, as required by the Board in its Recommendation A–95–25, and now suggests a December 1997 compliance date for retrofit of these airplanes.

In addition, for newly manufactured airplanes, the NTSB comments that most of the 88 parameters included in the FAA's proposal are currently being recorded, or are capable of being recorded with little cost, by existing FDR systems. Therefore, the NTSB believes that there does not appear to be a justifiable technical or economic reason for not requiring a full 88-parameter installation on newly manufactured aircraft by 3 years after the date of the final rule.

The NTSB also comments that the parameter "Overspeed Warning" should be added to the parameter list for newly manufactured airplanes, and that the final rule should explain in greater detail the significance of the Appendices Header, which reads "The recorded values must meet the designated range, resolution and accuracy requirements during dynamic and static conditions. All data recorded must correlate in time to within one second." The NPRM does not make it clear that this statement may have a significant impact on some existing airplanes with FDR parameters that do not reflect the actual condition of the aircraft during certain dynamic conditions. Certain data may not be recorded accurately due to filtering that takes place prior to recording.

The NTSB would like the FAA to change the proposed language to require non-FDAU equipped aircraft to be equipped with FDAU's and believes that the benefit would justify the additional $50,000 per aircraft cost of this retrofit. Adding a FDAU enables the recording of all the FDR parameters recommended by the Board in Recommendation 95–26. It would also provide reserve capacity for future FDR parameter needs that may become necessary in the future as a result of accident investigations and/or technology advancements.

In addition to the 1997 compliance date for Boeing 737 retrofits and the 3-year compliance date for newly manufactured airplanes, the NTSB suggests that industry should be able to retrofit the affected existing fleet within 2 years from the issuance of the final rule, rather than the 4 years proposed in Notice 96–7.

FAA Response: The FAA has fully explored with ARAC the NTSB recommendations concerning the Boeing 737 and a 2-year versus 4-year compliance date. During the course of the ARAC working group deliberations, the aircraft manufacturers presented and justified arguments that they would need more than 3 years to incorporate the engineering designs necessary to accommodate the proposed parameters

the cause of incidents and accidents. Finally, the FAA determined that a 4-year compliance time would permit the operators to schedule DFDR retrofits during a major maintenance check, e.g., a ''D'' check, while the aircraft is at a maintenance facility that has the equipment and technical capability to perform the installation and the modifications to the airframe. The NTSB has presented no new persuasive arguments that would justify changing the proposal.

Since the Pittsburgh (Aliquippa) Boeing 737 accident, Boeing has concentrated its efforts on using the available actual data and derived data to better understand the possible causes of this accident. Boeing has recently introduced changes in the Boeing 737 rudder system that it believes will prevent future rudder-induced rollover accidents. The FAA acknowledges the merits of the Boeing program and notes that such activities could be cut short if time and resources had to be directed toward meeting an accelerated DFDR retrofit schedule. At best, the recording of additional parameters may highlight where a problem exists. The rudder redesign efforts of Boeing, however, are a positive action that might prevent future accidents, and care must be taken not to inhibit such actions unnecessarily.

At the 1995 public hearing on flight data recorder upgrades, the FAA stated that it hoped that airlines would not wait for a government mandate before upgrading recorders. The FAA has received information that at least one major operator of Boeing 737 airplanes has already made a substantial commitment to upgrading its airplanes before the compliance date mandated in this rule. The FAA applauds this dedication to an important safety initiative and encourages equally aggressive compliance schedules from other operators.

The Board's suggestion to add to the parameter list of ''Overspeed Warning'' was not raised during the NTSB's participation in the ARAC working group. The FAA is not including in the final rule in an effort to maintain consistency with the proposed rule and the substantial cost analyses done by industry for the parameters already proposed. The FAA will consider adding the parameter in future rulemaking.

The NTSB requests a more detailed explanation of the Appendices Header that, as proposed, reads: ''The recorded values must meet the designated range, resolution and accuracy requirements during dynamic and static conditions. All data recorded must correlate in time to within one second:.'' The FAA added the requirement for a *dynamic* test condition to ensure accurate dynamic recording of aircraft performance. This requirement was necessary to preclude the presumption that information that may be obtained from filtered or modified signals. Correlation must be within one second between recorded data and actual performance. The FAA agrees that further explanation of these tests is needed, and intends to address the test procedures in an upcoming Advisory Circular to clarify the recording of dynamic and static conditions, and other acceptable means of compliance with the rule.

The original NTSB recommendations did not fully recognize the considerable constraints of DFDR retrofit of older airplanes that are out of production and are not equipped with flight data acquisition units (FDAU's), and for transport category airplanes whose type certificates apply to airplanes still in production. The NTSB did not recommend that 88-parameter recorders be installed in those airplanes. The ARAC team discussed the differences between FDAU-equipped and non-FDAU-equipped airplanes and recognized that the NTSB recommendation could not be fully accommodated without a FDAU retrofit of older airplanes. However, the costs related to redesign and retrofit were found to be excessive when compared to the benefits gained in older, less complex airplanes. Therefore, the ARAC team recommended different retrofit requirements for three different categories of airplanes, depending on their age and equipment already installed. Those categories and requirements were discussed in Notice No. 96–7, and are summarized in a chart printed in this preamble. The FAA has fully debated this issue and disagrees with the NTSB comment concerning FDAU retrofit of older airplanes, including that an additional $50,000 cost per older aircraft is justified. The FAA finds that the NTSB has submitted no new information that either was not considered by the FAA or that would justify developing a supplemental notice to incorporate this comment. No changes have been made as a result of the NTSB comment.

Several members on staff at the West Virginia University (WVU) comment that a virtual flight data recorder that they have been developing is capable of achieving the same result that an actual flight data recorder can, at much lower costs to industry. Congressman Nick J. Rahall II and Senator

addressed in this final rule, especially considering the NTSB's expressed need for directly recorded data. No change was made as a result of this comment.

An individual comments that the FAA does not provide a cost benefit analysis in the NPRM. In addition, the commenter believes the proposed rule is unnecessary and will not automatically improve aviation safety. He presents a number of hypothetical probable causes for accidents discussed in the preamble of the NPRM and suggests that improved inspection, maintenance, and training would better serve to prevent similar accidents. The commenter also states that it is necessary to record both pilots' inputs (force and displacement) as well as the control surface positions.

FAA Response: The NPRM contains a summary of a cost-benefit comparison. A more complete analysis is contained in the docket. The FAA disagrees that the proposed rule is unnecessary, although the immediate safety benefits may not be readily apparent. Currently, DFDR's are being used to aid accident investigation. Furthermore, the FAA is convinced that the enhanced data collection required by this rule will improve the accuracy and completeness of accident and incident investigations through the collection and analysis of more information. In addition, the FAA finds that the enhanced data collection required by this rule, and other voluntary measures being implemented by the air carriers, will provide enough data to recognize trends that may adversely affect flight operations in certain airplanes. Manufacturers and operators can analyze these trends and take corrective measures, if necessary, to avoid potential accidents or incidents.

The FAA agrees that improved inspection, maintenance, and training are important elements of preventing accidents, but that there is no acceptable substitute for the additional data that will be gathered as a result of this rule.

Regarding the comment on the requirement for recording from the pilot and the copilot both force and displacement, the FAA maintains that the rule provides for the recording of both pilots' inputs. For clarification, the information in the "Remarks" column has been revised in the final rule.

An individual comments that he would like to see another item added to the NPRM in light of the recent crashes of ValuJet and TWA. Specifically, he suggests that the rule require an independent, lightweight, stand-by power supply to the CVR and FDR in the event of main bus power failure. He believes that power source should be available for 5 to 10 minutes. He believes that the NTSB agrees with his comment and asks for consideration in future rules if this comment cannot be included in this rulemaking.

FAA Response: The commenter did not present enough information to support the idea that a stand-by power supply would be useful during a catastrophic failure in which the recording sensors are disabled or destroyed. Since power sources for flight data recorder equipment were not part of the notice, the comment is beyond the scope of the rule, and no changes were made as a result of this comment.

Discussion of Comments to Proposals for Part 129

Airbus Industrie comments that it believes the most recent international standards, as established by ICAO, should be sufficient to meet the intent of the NTSB recommendations, and believes that to require additional standards for non-U.S. operators would impose heavy retrofit costs. The commenter believes that most parameters proposed can, with currently installed equipment, be either recorded directly or reliably determined from other data, and requests that more flexibility be allowed to derive certain parameters from other data as an alternative to direct recording.

FAA Response: The ARAC working group made every effort to make the proposal identical, where applicable, to the requirements of ED–55. However, the FAA has determined that those requirements alone are insufficient to satisfy the NTSB recommendations for U.S.-registered airplanes. Also, the FAA recognizes that there may be alternative methods available to obtain information, other than direct recording, but has determined that direct recordation is the most reliable method, and the best one to accomplish the needs of the NTSB. The NTSB has investigated a number of proposals wherein the proposed parameters were derived; however, the NTSB was not convinced that the methodology demonstrated was as accurate as direct recordation. No changes were made as a result of this comment.

Japan Airlines Company, Ltd. (JAL) comments that its Aircraft Integrated Monitoring System (AIMS) FDAU is almost fully occupied by parameters that JAL uses for monitoring on-board and ground-based operations. JAL maintains that requiring the recordation of additional parameters or increasing sampling rates would require modifications (including reviewing and rearranging all of the word slot assignments in its FDAU's) that would cost several million dollars and would require several months to accomplish. JAL requests that the FAA exempt from the final rule those airlines that are currently operating with AIMS, or to exempt those airlines from the proposed increased sampling rates for DFDR parameters.

FAA Response: As stated previously, the FAA acknowledges that some operators may have to change their preferred programming to accommodate recordation of the required parameters. The categories of aircraft retrofit created by this rule were chosen carefully to account for the majority of aircraft of a certain age and equipment installations. The requirements were set so as to not require overall equipment replacement for minimal gains. Accordingly, the FAA cannot exempt any aircraft simply because it is part of an AIMS-type system, as suggested by the commenter, without ignoring the carefully established categories. Moreover, JAL states that ''most of the newly-requested parameters are already recorded in (JAL's) DFDR,'' and that compliance would require a rearrangement of word slot assignments. JAL has not shown that this presents an undue regulatory burden or one that was not already considered by the FAA in this rulemaking.

The FAA again acknowledges that this rule will place some economic burdens on operators. Discussion of comments on economic issues can be found in the Regulatory Evaluation section of this preamble.

No other comments were received pursuant to these proposals. In the absence of sufficient, persuasive justification that is necessary to change the proposed regulations, they are adopted as proposed.

Discussion of Comments to the SNPRM

Two commenters stated that they support the proposals in the SNPRM.

TOIL submitted further comment to justify exemption of the DHC–6–300 from the DFDR retrofit requirements. The commenter's main concern is with ''the proposed reversal of policy established by Flight Standards Information Bulletin 92–09'' and again urges the FAA to adopt its previous policy interpretation regarding airplanes brought onto the register after October 11, 1991, and to codify that previous policy. TOIL did not offer comments on the proposals in the SNPRM.

FAA Response: The commenter seems to have misunderstood that the change in policy announced in the NPRM was a ''proposed'' reversal of policy. The change in policy was a determination already made; the NPRM was merely a conduit for announcing the change since the subject matter was relevant to the NPRM and the affected parties would be notified more efficiently using that document. As stated in the NPRM and the SNPRM, the previous policy interpretation was found to be inconsistent with the text of the rule. The FAA cannot, in good faith, allow operators to continue to operate without complying with the rule and has made no changes to the rule addressing the change of policy. Further explanation is provided in this preamble in the section, ''Discussion of Policy Change'' below.

One individual commented that the rule should address alternate methods of powering recording devices, stating that sometimes the busses powering the recorders are turned off for isolation purposes in the event of an emergency that involves fire or smoke.

FAA Response: The FAA acknowledges the merit of this comment; however, the issue it addresses is outside the scope of this rulemaking; it may be considered in a future rulemaking action. No changes were made as a result of this comment.

RAA comments that neither the NPRM nor the SNPRM have provided data to suggest that adoption of the proposals will result in a reduction of accidents, and therefore the final rule should not be applicable for aircraft where it is shown that disproportionate economic hardship would result. The commenter feels that aircraft with 10 to 19 passenger seats should be affected only if they are newly manufactured after October 11, 1991 (as opposed to being brought onto the U.S. register, as the rule currently states).

in this comment refer only to the DHC–6–300, an airplane with a unique combination of cost factors. The FAA has determined that the DHC–6 will not have to comply with the DFDR requirements. Other operators that can justify why their airplanes should also be exempt, discussing the criteria outlined in the preamble of the NPRM and the SNPRM, may petition to have their airplanes added to the exemption paragraph in part 135.

The FAA agrees that the 2-year compliance time for airplanes of operators that "thought their aircraft were grandfathered to meet the current requirements of part 135, not for installation of an upgrade" should be revised to read 4 years, and those affected airplanes will have 4 years to come into compliance. The compliance time language that was included in the SNPRM has been removed to avoid any confusion in compliance times. Affected operators have four years to comply, whether operating under part 135 or part 121. Further explanation is provided in this preamble in the section, "Discussion of Policy Change" below.

The NTSB agrees with the intent of the SNPRM, but comments that specific language is needed to prevent part 121 operators from operating foreign-registered aircraft fitted with FDR's that have as few as five parameters. The commenter also states that the language intended to correct the policy decision discussed in the NPRM and SNPRM is somewhat confusing. The commenter feels that exemptions to § 135.152 should be handled through the exemption process on a case-by-case basis rather being addressed in rule language, and agrees that the "out of production" argument is not a sufficient reason for exclusion. The NTSB agrees that the increase in the minimum FDR recording duration for part 135 aircraft from 8 to 25 hours is an appropriate and timely change.

FAA Response: The language proposed in the SNPRM, that the flight data recorder requirements of § 135.152 apply to aircraft registered outside the United States but placed on the U.S. operations specifications of an operator, is included in the final rule. In its comment, the NTSB indicates that specific language should also be added to part 121 requirements to ensure that all aircraft operated in part 121 service, including those under foreign registration, are operated in accordance with the flight data recorder requirements of that part. The NTSB indicates that § 121.153 would permit the use of foreign-registered aircraft that record only 5 parameters of flight data. The FAA disagrees with the NTSB's reading of § 121.153. Paragraph (c)(2) of that section requires that foreign-registered aircraft operated under part 121 must meet all of the requirements "of this chapter (14 CFR Chapter 1)," which includes all of the part 121 requirements. Thus, any foreign-registered airplane operated under part 121 must meet the FDR requirements as though the aircraft were registered in the United States.

However, after further consideration, the FAA has decided that § 121.344a should contain the same language as § 135.152 concerning aircraft placed on the operations specifications of an operator. The "brought on the U.S. register" language of § 135.152 was repeated in new § 121.344a(a), and the correction proposed for § 135.152(a) in the SNPRM also applies to § 121.344a(a). The language is included in the final rule for clarity and parallelism between the two sections. The FAA does not want to cause confusion in the applicability of § 121.344a for airplanes that are subject to it beginning in March 1997.

The FAA agrees that the simple fact that airplanes are out of production is not sufficient justification for their exclusion from the DFDR requirements. The number of out of production airplanes still operating is significant, and many airplanes have too much economic life remaining to allow them to operate with no or limited flight data recorders. The FAA disagrees that any exception to this rule be handled as exemptions on a case-by-case basis. The FAA does not grant blanket permanent exemptions, and use of that process would necessitate the reapplication of affected parties every two years. The FAA does not anticipate that circumstances would change so as to justify later the retrofit of the airplanes listed in this final rule as exempt. Further, because these exceptions are listed for aircraft types, it is more efficient to list them as part of the rule rather than having individual operators apply on behalf of themselves and all affected operators of a certain airplane type design.

Discussion of Policy Change

In the preamble to Notice No. 96–7, the FAA announced a change in policy regarding certain airplanes that were brought on the U.S. register after October 11, 1991 (61 FR 37154, July 16, 1996).

Comments to the NPRM and SNPRM, and telephone inquiries by operators, indicate to the FAA that some commenters thought that this was a *proposed* policy change. Commenters also took the opportunity to suggest alternative policies to cover these airplanes, including a change in § 135.152 to make it applicable only to airplanes manufactured after October 11, 1991. (See response at discussion of TOIL's comments, above.) Further, the NPRM did not contain any proposed compliance time for aircraft affected by the policy change, nor did it specifically indicate that the policy change affects all aircraft—airplanes and rotorcraft—subject to § 135.152.

In the SNPRM, the FAA proposed to give operators that had been operating under the old policy two years to comply with the regulation. The commenters note, however, that this places a burden on some operators, and could cause operators of certain airplanes that are now subject to part 121 requirements to possibly undergo a second retrofit—first to meet § 135.152 because of the policy change and again to meet § 121.344a.

The FAA agrees that the proposed compliance time of two years may be short, and understands the confusion that resulted from the change in policy being announced in the NPRM and discussed again in the SNPRM. Accordingly, the policy change is effective on the effective date of this final rule. Operators of airplanes or rotorcraft that were operating pursuant to the old policy will have four years from the effective date of this rule in which to comply with § 135.152. Affected operators should note, however, that there is *no change to the rule language* of § 135.152 to indicate that this compliance period exists. The FAA found that a change in the rule language could be interpreted to apply to all operators, rather than those affected by the policy change; the compliance date proposed in the Supplemental Notice is not adopted in this final rule.

Changes Adopted in the Final Rule

As a result of comments to the NPRM, the following changes were made:

(1) The Lockhead Aircraft Corporation Electra L–188 airplane was added to the list of airplanes that need not comply with proposed §§ 121.344 and 125.226, but must continue to comply with §§ 121.343 or 125.225, whichever is appropriate;

(2) The reference to Fairchild Aircraft, Inc. FH 227 was corrected to reflect the manufacturer of the FH 227 is Fairchild Industries;

(3) In all appendices, the following comment was added to the Remarks column for Parameter #88: For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control force inputs. The control force inputs may be samples alternately once per 2 seconds to produce the sampling interval of 1;

(4) Technical changes to the appendices, including sampling rates; and

(5) Typographical errors were corrected and minor editorial changes were incorporated.

As a result of the SNPRM and comments to the SNPRM, the following changes were made:

(1) Proposed § 121.344a(a) and comment § 135.152(a) were revised to include turbine-engine-powered airplanes having a passenger seating configuration, excluding any required crewmember seat, of 10 to 19 seats, that were brought onto the U.S. register after, *or* that were registered outside the United States and added to the operator's U.S. operation specifications after, October 11, 1991;

(2) Section 135.152(k) was added to state that the deHavilland DHC–6 (The Twin Otter) airplane need not comply with DFDR rules. Parts 121 and 125 already included exception paragraphs; the DHC–6 was the only part 135 airplane for which justification was shown to grant noncompliance;

(3) References in part 135 to 8 hours of recorded aircraft operation were revised to read 25 hours, which reflects the current industry standard; and

(4) The rule language proposed in the SNPRM to allow a 2 year compliance time for airplanes currently not in compliance was not adopted in the final rule. These aircraft were operating without

Category 1 No FDAU*, mfd on or before 10/11/91	Category 2 FDAU, mfd on or before 10/11/91	Category 3 FDAU, mfd after 10/11/91	Category 4 FDAU, mfd 3 (or 5) years after final rule
CURRENT PARAMETERS			
11 parameters	17 parameters	Up to 29 parameters	29 parameters
PROPOSED PARAMETERS			
17/18 parameters	17–22 parameters	34 parameters	57 parameters (3 years) 88 parameters (5 years)
AIRPLANES			
1929 airplanes over 30 seats; 727, 737, DC–8, DC–9, F–28	1360 airplanes over 30 seats 704 turboprops A–320, 737, 747, 757, 767, DC–10, F–28, MD–80, ATR–42, EMB–120, SAAB 340, DHC–8, L–1011	1036 airplanes over 30 seats 673 airplanes 10–19 seats 277 airplanes 20–30 seats 737, 747, 757, 767, 777, F–100, MD–11, MD–80, MD–88, MD–90, ATR–72	All newly manufactured airplanes Existing derivatives and any new type certificates

*FDAU=Flight Data Acquisition Unit

International Compatibility

The FAA has reviewed corresponding International Civil Aviation Organization regulations and Joint Aviation Authority regulations, where they exist. Any differences between those documents and these regulations are of a minor, technical nature, and are deemed insignificant. As noted in the discussion of comments, the review included the technical material for parameters numbered 1 through 57. Beyond parameter 57, no international standards exist. The differences noted above will not adversely affect harmonization.

Paperwork Reduction Act

This final rule contains information collections which are subject to review by OMB under the Paperwork Reduction Act of 1995 (Pub. L. 104–13). The title, description, and respondent description of the annual burden are shown below.

Title: Revisions to Digital Flight Data Recorders Rules.

Description: This regulation revises and updates the Federal Aviation Regulations to require that certain airplanes be equipped to accommodate additional digital flight data recorder (DFDR) parameters. These revisions follow a series of safety recommendations issued by the National Transportation Safety Board (NTSB), and the Federal Aviation Administration's (FAA) decision that the DFDR rules should be revised to upgrade recorder capabilities in most transport airplanes. These revisions will require additional information to be collected to enable more thorough accident or incident investigation and to enable industry to predict certain trends and make necessary modifications before an accident or incident occurs.

Description of Respondents: Businesses or other for profit organizations.

There are no annual reporting or recordkeeping burdens associated with this rule. The information is collected automatically, electronically. It is retained for only 25 hours, and is overwritten on a continuing basis. In the event of an accident or incident, the information is downloaded by the NTSB as a part of its statutory mission. The airplane operators are not required to keep the information, nor to report it.

Cost estimates shown here are aggregates for the entire 4-year compliance time frame. In determining capital and start-up costs to the airline industry, the FAA has assumed that in determining the figures, commercial airline operators took into account the annualized expected useful life of the equipment to

of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used; (3) enhance the quality, utility, and clarity of the information to be collected; and (4) minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Individuals and organizations may submit comments on the information collection requirements by September 15, 1997, and should direct them to the address listed in the "ADDRESSES" section of this document. Comments should also be submitted to the Office of Information and Regulatory Affairs, OMB, New Executive Office Bldg., Room 10202, 725 17th St. NW, Washington, DC 20503, Attention, Desk Officer for FAA.

Persons are not required to respond to a collection of information unless it displays a currently valid OMB control number. The burden associated with this final rule has been submitted to OMB for review. The FAA will publish a notice in the *Federal Register* notifying the public of the approval numbers and expiration date.

Regulatory Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effect of regulatory changes on international trade.

With regard to Executive Order 12866, the FAA determined that this rulemaking is significant because of the substantial public interest in obtaining flight data and the NTSB's ability to conduct full investigations. Accordingly, the FAA evaluated two alternative approaches. In consideration of these alternatives, the FAA has concluded that (1) shortening the compliance time frame to two years as analyzed in the NPRM, would increase the cost of this rulemaking by as much as $170.6 million, discounted; and (2) adopting a simulator methodology to obtain more DFDR parametric detail, although less costly, would not measure all parameters specified in this final rule, nor satisfactorily meet the needs of the NTSB. Hence, the FAA has rejected both of these alternative approaches.

With regard to the Regulatory Flexibility Act of 1980, the FAA has determined that a substantial number of small entities will not be significantly affected economically by this final rule. With regard to the OMB directive, the FAA has concluded that this final rule could have a potential, but insignificant, indirect affect on international trade. A full regulatory evaluation of the final rule providing a detailed discussion of the costs and benefits summarized in this section is available in the docket for this rulemaking action.

Costs

To obtain representative and comprehensive information from which to develop the industry costs of this final rule, the FAA relied on the responses of the Air Transport Association (ATA) and the Regional Airline Association (RAA) members to an air carrier cost survey developed by the ARAC working group. (The FAA augmented this information with adjusted cost analyses from the recently effectively commuter rule). The principle aggregate costs detailed in the cost survey were (1) equipment and inventory/spares; (2) engineering, installation, and other costs, inclusive of recurrent maintenance costs; and (3) aircraft out-of-service costs, which reflect net operating revenue losses resulting from unscheduled aircraft downtime.

The FAA estimates that total costs for air carriers operating turbojets under part 121 would equal $308.9 million ($259.1 million, discounted) within the 4-year compliance time frame of this rulemaking. The equivalent total turboprop fleet costs for air carriers operating under part 121 are estimated to be $30.4 million ($25.8 million, discounted) under the same 4-year compliance time frame. Estimates of the total 4-year compliance time frame costs for part 135, 10–19 seat aircraft required to operate under

that result from this rulemaking. No similar estimates of the out-of-service costs were provided to the FAA for either the turboprop fleet or part 135 carriers that will now be required to operate under part 121. Proportionately however, the FAA does not expect these to be significantly different than those estimated for the turbojet fleet.

Benefits

The FAA finds that the benefits that will result from this final rule can be considered as two interrelated areas. First, there are inherent, non-measurable benefits that evolve from increasing the volume of detailed accident and incident information from which the aviation industry as a whole can draw upon as an added resource. Second, there are the direct, measurable benefits that would result from potentially averting an accident as a result of the DFDR enhancements.

In the first instance, this final rule supports the recent voluntary efforts of those air carriers that have introduced data acquisition enhancements into their newer model airplanes. This subset of new airplanes with upgraded DFDR's has provided certain air carriers with "quick access" capability and allowed for the development of integrated maintenance and training programs predicated on the additional information being collected. It has also allowed for more rapid and comprehensive detail to be obtained by the FAA and NTSB in certain recent airplane accidents. The inherent benefits resulting from this rulemaking will evolve as all commercial air carriers adopt the required DFDR enhancements in their airplanes.

Although DFDR's do not in and of themselves prevent accidents, through their use as an investigative tool when accidents or incidents do occur, trends that may adversely affect flight operations in certain airplanes can be determined. Accident investigators in obtaining a greater understanding of the accident dynamics from the DFDR information, can, in turn, be used to more easily determine the probable causes of accidents and incidents. With this knowledge, a "fix" can be developed to reduce the chance of a similar occurrence in the future.

In the second instance noted above, although the FAA is not able to quantify precisely the likely benefits that will ultimately result from this rulemaking, the FAA anticipates that the DFDR enhancements required by this final rule will lead to a reduction in accidents and a saving of lives. As a result of analyzing incidents involving aircraft with DFDR enhancements in place, the FAA finds that there is a reasonable prospect that as many as 1.43 accidents could be prevented over the next 20 years. This could save up to 143 lives. The FAA anticipates that, particularly in light of the NTSB recommendations, information concerning enhanced parameters can be collected cost-effectively; it is also expected that the FAA will be able to use incident information to reduce accidents of the nature that are currently of undetermined cause.

Benefit Cost Comparison

The FAA cautions that the cost analysis detailed in the preceding sections is not necessarily exhaustive. The purpose of this rulemaking is to require the installation of DFDR's that record more flight information. This in turn, will allow industry to recognize certain trends in order to make any necessary modifications to avoid future accidents or incidents. Thus, the FAA presumes that, as a result of this rulemaking, the quantity and quality of information will increase. To the extent that NTSB is able to make findings of probable cause in the event of accidents or incidents, the FAA will be able to determine what, if any, appropriate additional action is needed to prevent a recurrence of those kinds of accidents or incidents.

Future FAA actions could take the form of Advisory Circulars, Airworthiness Directives, or possibly, additional rulemaking. The costs of these follow-on FAA actions could vary from negligible costs to considerable costs of some unknown amount. While the costs of such future follow-on actions by the FAA might be considered part of the costs of this rulemaking, the FAA cannot estimate the costs of these unknown future actions. The FAA acknowledges that, to the extent that the costs of any follow-on actions are more than negligible, the current cost estimates would tend to underestimate the total cost of this rulemaking.

Several commenters addressed specific issues with regard to airplanes currently operating under part 135. Piedmont Airlines notes that the recorders currently used in its ATR–72 record 98 parameters and those used in its SAAB 340 record 128 parameters. In both cases, certain of the parameters specified by this rulemaking are not currently being recorded but could be derived; the cost however, to retrofit these airplanes to be in compliance would be about $100,000 per aircraft. Similarly, Aerospatiale and Alenia (ATR), manufacturers of ATR airplanes, suggest some requirements flexibility should be introduced for those airplanes such as the ATR 42/72 with recorder requirements that are essentially in harmonization with EUROCAE ED–55 requirements.

Comments submitted by the RAA include statements by RAA members that question the rationale of including for retrofit certain aircraft that currently have demonstrably effective recorder systems. In addition to the above noted ATR 42, ATR 72, and SAAB 340, the RAA, in an attachment submitted by Atlantic Southeast Airlines, Inc. (ASA), objects to the retrofit of BAe 146 and EMB–120 aircraft. ASA also cites a previous estimate submitted by Aerospatiale to retrofit the ATR 72 as costing $30,000 and 20 man-hours per aircraft, and a previous estimate submitted by AVRO to retrofit the BAe 146 as costing $110,000, 1200 man-hours, and 2.5 weeks downtime per aircraft.

In another statement submitted with the RAA comment, Comair believes the recorder capabilities currently employed on its in-service fleet far exceed those of the rulemaking's ''target aircraft'', e.g., older 737's and DC–9's. Comair also provided retrofit cost data for its fleet of 40 Embraer EMB 120 aircraft ($51,450 and 6 days downtime per aircraft) and its fleet of 70 Canadair CL600–2B19 regional jets ($136,600 and 6 days downtime per aircraft). Although not part of the RAA comment and attachments, Embraer also provided detailed cost information for the retrofitting of the EMB–120 aircraft under each of the categories specified in the rule. Embraer's retrofit cost estimates are more in line with those presented in the NPRM and considerably less than those cited above.

A statement from USAir Express notes that the cost data submitted by the RAA were primarily for aircraft operated by RAA members under part 121, not part 135 as estimated in the regulatory evaluation; only the EMB–120 is operated exclusively under part 135. As a consequence, RAA/USAir Express suggest that the FAA cost estimates for retrofitting aircraft operating under part 121 are from 5 percent to 10 percent low.

Finally, Twin Otter International (TOIL) contends that the DHC–6–300, which is no longer in production, was not designed for FDR's and no engineering data exists to support an FDR installation. TOIL estimates the costs to redesign the DHC–6–300 aircraft systems and recertify would be in excess of $130,000, and deHavilland, the Twin Otter manufacturer, has no interest in participating in the cost of certifying/retrofitting the DHC–6–300. TOIL concludes that application of the rule would inhibit the ability of U.S. operators to purchase additional aircraft, particularly since the majority of available Twin Otters are registered outside the U.S.

FAA Response: The FAA appreciates the additional cost detail regarding aircraft operating under part 135 as provided in these comments, as well as the clarification of the cost detail as provided by the RAA. The FAA relied heavily on ARAC working group members to supply accurate and timely cost detail and economic information. This reliance also assumed that the cost detail supplied clearly delineated the retrofit costs associated with aircraft operating under part 135 from those operating under part 121.

With regard to the so-called ''requirements flexibility'' or possible exemption of certain aircraft, this is not a matter for consideration in the regulatory evaluation. It should be noted that the ARAC working group, with significant industry input, concluded that the differences between the NTSB recommendations and ED–55 would be insignificant for U.S. operators. Finally, with regard to the DHC–6–300 airplane (the Twin Otter) the FAA received sufficient information to support the exemption of these aircraft operated under part 135. Section 135.152(k) was added to provide that exemption.

Several comments were received regarding the 88 parameter list for airplanes in category V (those that will be manufactured five years after the effective date of this rule), most of which noted the absence of a detailed cost/benefit analysis specific to this requirement for future newly manufactured

that newly manufactured 10–19 seat airplanes should be required to have either 57 parameters within 3 to 5 years after issuance of the final rule or 88 parameters 5 years after issuance of the final rule. Fairchild Aircraft also maintains that compliance with § 135.152 is more than adequate for airplanes operating under part 135. Fairchild Aircraft, one of two U.S. manufacturers of commuter category airplanes also included aggregate recurring and non-recurring cost estimates for retrofitting its Metro 23 airplane to be in compliance with final rule's 57 and 88 parameter requirements. The General Aviation Manufacturers Association (GAMA) notes that under all scenarios, the cost of this rule exceed the benefits and faults the FAA with not having developed separate cost/benefit analysis for newly manufactured aircraft (57 or 88 parameters); GAMA believes this to be required under the law. Finally, ATA contends that the disharmony arising over the 31 parameter discrepancy (88 vs. 57 parameters) would affect sales/transfers of airplanes between European airlines/carriers and U.S. airlines/carriers.

FAA Response: The FAA notes that no cost detail for the 88 parameter list was included in the information provided by ATA or RAA for analysis in the NPRM, and the detail that was provided for the 57 parameter list was incomplete and essentially unusable. In both cases, this was due to the lack of adequate vendor cost detail for products which may not even be on the market as yet, and the generally speculative nature that would be required of air carriers in developing macro cost breakouts for newly manufactured airplanes in the future. These impediments were recognized by the ARAC working group, and, as a consequence, no request for this information was tendered.

With regard to the remaining issues noted above concerning the parameter requirements of newly manufactured airplanes, the potential cost burden, and the apparent excessive cost/benefit ratio, Federal regulations in general, require only that the complete rule be subjected to a cost/benefit analysis, not its component parts. Furthermore, although the cost information provided by ATA and RAA allowed detailed analysis of the first three aircraft categories, an analysis of the benefits cannot be estimated in similar manner; benefits therefore, were determined for the overall rule. Finally, as noted in the preamble, cost alone cannot justify ignoring the recognized potential safety gains inherent in this rule, the inclusion of certain airplanes now operating under part 135 to comply with the requirements of part 121 is a result of the commuter or "one level of safety" rule.

With regard to parts vendors and the disaggregation of materials costs, comments were received from two suppliers (Flight Systems Engineering, Inc. and Patriot Sensors and Controls Corporation) and one trade association (Airlines Pilot Association (ALPA)). The vendors' comments addressed the costs of specific equipment components and the lead time required to meet orders. A portion of ALPA's comments focused on the need for a more extensive review of cost data and recommended contacting individual manufacturers of FDRs and FDAUs.

FAA Response: The FAA appreciates the logistics information regarding vendor lead times which are well within the 4-year compliance time of this final rule. The FAA however, notes that the cost data developed for this rulemaking was provided by ATA and RAA at the aggregate level; it does not lend itself to the micro detail of specific retrofit components. No changes to the regulatory evaluation or the rule were made in response to these comments.

Finally, a comment was submitted by the Department of Civil and Environmental Engineering of the University of West Virginia (WVU) proposing an alternative approach to the retrofitting requirements of this rule based on Artificial Intelligence, or more specifically, Neural Network theory. Relying on an alternate set of assumptions, the WVU team estimates the cost of the DFDR final rule at $1.046 billion, or more than three times the FAA estimate, and offers their software-based system, the Virtual Flight Data Recorder (VFDR), as a low-cost alternative. Utilizing the data taken from an existing conventional 11-parameter FDR, the VFDR, according to the WVU team, would accurately "reconstruct" most of the additional parameters detailed in the final rule via a Neural Network mapping process at a cost of about $800–$1,000 per aircraft, or about 1 percent of their cost estimate for this final rule. The WVU comment concludes that the opportunity cost of the hard retrofit is lost savings which could be invested in a variety of safety enhancements.

FAA Response: The FAA appreciates the efforts of the WVU team in presenting an innovative, low-cost "simulator" alternative to the hardware retrofits that will be required by this rule. However,

Final Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Federal regulations. The RFA requires regulatory agencies to review rules which may have "a significant economic impact on a substantial number of small entities." For this final rulemaking, a "small entity" is an operator of aircraft for hire that owns, but does not necessarily operate, nine (9) aircraft or fewer. A "substantial number of small entities", as defined in FAA order 2100.14A—Regulatory Flexibility Criteria and Guidance, is a number (in this instance, the number of operators) that is not fewer than eleven and is more than one-third of the small entities subject to final rule.

A "significant economic impact" or cost threshold, is defined as an annualized net compliance cost level that exceeds (1) $122,400 (1995 dollars) in the case of scheduled operators of aircraft for hire whose entire fleet has a seating capacity in excess of 60 seats; (2) $69,800 (1995 dollars) in the case of scheduled operators of aircraft for hire for which the entire fleet has a seating capacity less than or equal to 60 seats; and (3) $4,900 (1995 dollars) in the case of unscheduled operators of aircraft for hire.

The FAA has determined the annualized costs (20 years) for scheduled operators of large aircraft to be $5,611 per aircraft. Multiplying this estimate by 9, (the upper bound of the small entity criteria) yields a result of $50,501. This estimate is significantly below the minimum compliance cost criteria of $122,400 for scheduled operators of large aircraft.

The FAA has also determined the annualized costs (20 years) for scheduled operators of small aircraft to be $3,067 per aircraft. The upper bound costs for consideration within the small entity (9 aircraft) criteria are $27,603, which is well below the minimum compliance cost of $69,800. Thus, the FAA has determined that a substantial number of small entities will not be significantly affected by this final rule.

International Trade Impact Assessment

The FAA anticipates that revisions to digital flight data recorder rules could have some indirect affect on international trade. The FAA finds that while the final rule will not effect non-U.S. operators of foreign aircraft operating outside the United States, it could affect the suppliers of materials required for retrofitting the affected aircraft in the domestic fleet. Domestic sources of the required retrofit components may not be able to meet all of the increased demand of the domestic air carriers for DFDR's as these air carriers increase their orders to meet the compliance time frame for these regulations. Foreign producers may benefit by supplying the unfilled orders.

Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this final rule is a significant regulatory action under Executive Order 12866. In addition, the FAA certifies that this rule will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This rule is considered significant under Department of Transportation Order 2100.5, Policies and Procedures for Simplification, Analysis, and Review of Regulations. A regulatory evaluation of the rule, including a Regulatory Flexibility Determination and International Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under the heading "FOR FURTHER INFORMATION CONTACT."

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends 14 CFR parts 121, 125, 129 and 135 of the Federal Aviation Regulations effective August 18, 1997.

The authority citation for part 121 continues to read as follows:

§ 121.301 Applicability.

This subpart prescribes instrument and equipment requirements for all certificate holders.

§ 121.303 Airplane instruments and equipment.

(a) Unless otherwise specified, the instrument and equipment requirements of this subpart apply to all operations under this part.

(b) Instruments and equipment required by §§ 121.305 through 121.359 must be approved and installed in accordance with the airworthiness requirements applicable to them.

(c) Each airspeed indicator must be calibrated in knots, and each airspeed limitation and item of related information in the Airplane Flight Manual and pertinent placards must be expressed in knots.

(d) Except as provided in §§ 121.627(b) and 121.628, no person may take off any airplane unless the following instruments and equipment are in operable condition—

(1) Instruments and equipment required to comply with airworthiness requirements under which the airplane is type certificated and as required by §§ 121.213 through 121.283 and 121.289.

(2) Instruments and equipment specified in §§ 121.305 through [121.321, 121.359, and 121.360] for all operations, and the instruments and equipment specified in §§ 121.323 through 121.351 for the kind of operation indicated, wherever these items are not already required by paragraph (d)(1) of this section.

(Amdt. 121–44, Eff. 9/25/68); (Amdt. 121–65, Eff. 8/11/70); (Amdt. 121–114, Eff. 1/23/75); (Amdt. 121–126, Eff. 11/24/75); (Amdt. 121–122, Eff. 6/20/91); [(Amdt. 121–253, Eff. 2/26/96)]

§ 121.305 Flight and navigational equipment.

No person may operate an airplane unless it is equipped with the following flight and navigational instruments and equipment—

(a) An airspeed indicating system with heated pitot tube or equivalent means for preventing malfunctioning due to icing.

(b) A sensitive altimeter.

(c) A sweep-second hand clock (or approved equivalent).

(d) A free-air temperature indicator.

(e) A gyroscopic bank and pitch indicator (artificial horizon).

(f) A gyroscopic rate-of-turn indicator combined with an integral slip-skid indicator (turn-and-bank indicator) except that only a slip-skid indicator is required when a third attitude instrument system usable through flight attitudes of 360° of pitch and roll is installed in accordance with paragraph ([k]) of this section.

(g) A gyroscopic direction indicator (directional gyro or equivalent).

(h) A magnetic compass.

(i) A vertical speed indicator (rate-of-climb indicator).

(j) [On the airplanes described in this paragraph, in addition to two gyroscopic bank and pitch indicators (artificial horizons) for use at the pilot stations, a third such instrument is installed in accordance with paragraph (k) of this section:

(1) [On each turbojet powered airplane.

(2) [On each turbopropeller powered airplane having a passenger-seat configuration of more than 30 seats, excluding each crewmember seat, or a payload capacity of more than 7,500 pounds.

(3) [On each turbopropeller powered airplane having a passenger-seat configuration of 30 seats or fewer, excluding each crewmember seat, and a payload capacity of 7,500 pounds or less that is manufactured on or after March 20, 1997.

[(4) After December 20, 2010, on each turbopropeller powered airplane having a passenger seat configuration of 10–30 seats and a payload capacity of 7,500 pounds or less that was manufactured before March 20, 1997.]

(k) When required by paragraph (j) of this section, a third gyroscopic bank-and-pitch indicator (artificial horizon) that:

(1) Is powered from a source independent of the electrical generating system;

(5) Is located on the instrument panel in a position acceptable to the Administrator that will make it plainly visible to and usable by each pilot at his or her station; and

(6) Is appropriately lighted during all phases of operation.

(Amdt. 121–57, Eff. 2/5/70); (Amdt. 121–60, Eff. 5/9/70); (Amdt. 121–81, Eff. 1/3/72); (Amdt. 121–130, Eff. 11/26/76); (Amdt. 121–130, Eff. 10/15/92); (Amdt 121–230, Correction Eff. 4/2/93); (Amdt. 121–251, Eff. 1/19/96); [(Amdt. 121–262, Eff. 3/12/97)]

§ 121.307 Engine instruments.

Unless the Administrator allows or requires different instrumentation for turbine-engine-powered airplanes to provide equivalent safety, no person may conduct any operation under this part without the following engine instruments—

(a) A carburetor air temperature indicator for each engine.

(b) A cylinder head temperature indicator for each air-cooled engine.

(c) A fuel pressure indicator for each engine.

(d) A fuel flowmeter or fuel mixture indicator for each engine not equipped with an automatic altitude mixture control.

(e) A means for indicating fuel quantity in each fuel tank to be used.

(f) A manifold pressure indicator for each engine.

(g) An oil pressure indicator for each engine.

(h) An oil quantity indicator for each oil tank when a transfer or separate oil reserve supply is used.

(i) An oil-in temperature indicator for each engine.

(j) A tachometer for each engine.

(k) An independent fuel pressure warning device for each engine or a master warning device for all engines with a means for isolating the individual warning circuits from the master warning device.

(l) A device for each reversible propeller, to indicate to the pilot when the propeller is in reverse pitch, that complies with the following—

responsive to it.

§ 121.308 Lavatory fire protection.

[(a) Except as provided in paragraphs (c) and (d) of this section, no person may operate a passenger-carrying airplane unless each lavatory in the airplane is equipped with a smoke detector system or equivalent that provides a warning light in the cockpit or provides a warning light or audio warning in the passenger cabin which would be readily detected by a flight attendant, taking into consideration the positioning of flight attendants throughout the passenger compartment during various phases of flight.

[(b) Except as provided in paragraph (c) of this section, no person may operate a passenger-carrying airplane unless each lavatory in the airplane is equipped with a built-in fire extinguisher for each disposal receptacle for towels, paper, or waste located within the lavatory. The built-in fire extinguisher must be designed to discharge automatically into each disposal receptacle upon occurrence of a fire in the receptacle.

[(c) Until December 20, 1997, a certificate holder described in § 121.2(a)(1) or (2) may operate an airplane with a passenger seat configuration of 30 or fewer seats that does not comply with the smoke detector system requirements described in paragraph (a) of this section and the fire extinguisher requirements described in paragraph (b) of this section.

[(d) After December 20, 1997, no person may operate a nontransport category airplane type certificated after December 31, 1964, with a passenger seat configuration of 10–19 seats unless that airplane complies with the smoke detector system requirements described in paragraph (a) of this section, except that the smoke detector system or equivalent must provide a warning light in the cockpit or an audio warning that would be readily detected by the flightcrew.]

Docket No. 24073 (50 FR 12733) Eff. 3/29/85

(Amdt. 121–185, Eff. 4/29/85); [(Amdt. 121–251, Eff. 1/19/96)]

(1) Must be inspected regularly in accordance with inspection periods established in the operations specifications to ensure its condition for continued serviceability and immediate readiness to perform its intended emergency purposes;

(2) Must be readily accessible to the crew and, with regard to equipment located in the passenger compartment, to passengers;

(3) Must be clearly identified and clearly marked to indicate its method of operation; and

(4) When carried in a compartment or container, must be carried in a compartment or container marked as to contents and the compartment or container, or the item itself, must be marked as to date of last inspection.

(c) *Hand fire extinguishers for crew, passenger, cargo, and galley compartments.* Hand fire extinguishers of an approved type must be provided for use in crew, passenger, cargo, and galley compartments in accordance with the following—

(1) The type and quantity of extinguishing agent must be suitable for the kinds of fires likely to occur in the compartment where the extinguisher is intended to be used and, for passenger compartments, must be designed to minimize the hazard of toxic gas concentrations.

(2) *Cargo compartments.* At least one hand fire extinguisher must be conveniently located for use in each class E cargo compartment that is accessible to crewmembers during flight.

(3) *Galley compartments.* At least one hand fire extinguisher must be conveniently located for use in each galley located in a compartment other than a passenger, cargo, or crew compartment.

(4) *Flightcrew compartment.* At least one hand fire extinguisher must be conveniently located on the flight deck for use by the flightcrew.

(5) *Passenger compartments.* Hand fire extinguishers for use in passenger compartments must be conveniently located and, when two or more are required, uniformly distributed throughout each compartment. Hand fire extinguishers shall be provided in passenger compartments as follows—

accommodating more than 60 passengers, there must be at least the following number of hand fire extinguishers—

Minimum Number of Hand Fire Extinguishers

Passenger seating accommodations:	*No.*
61 through 200	3
201 through 300	4
301 through 400	5
401 through 500	6
501 through 600	7
601 or more	8

(6) Notwithstanding the requirement for uniform distribution of hand fire extinguishers as prescribed in paragraph (c)(5) of this section, for those cases where a galley is located in a passenger compartment, at least one hand fire extinguisher must be conveniently located and easily accessible for use in the galley.

(7) [At least two of the required hand fire extinguisher installed in passenger-carrying airplanes must contain Halon 1211 (bromochlorofluoromethane) or equivalent as the extinguishing agent. At least one hand fire extinguisher in the passenger compartment must contain Halon 1211 or equivalent.]

(d) *First aid and emergency medical equipment and protective gloves.*

(1) [For treatment of injuries or medical emergencies that might occur during flight time or in minor accidents each passenger-carrying airplane must have the following equipment that meets the specifications and requirements of appendix A of this part:

(i) Approved first aid kits; and

(ii) In airplanes for which a flight attendant is required, an emergency medical kit.]

(2) Pairs of protective latex gloves, or equivalent nonpermeable gloves, equal in number to the number of first aid kits on board the aircraft. These gloves must be distributed as evenly as practicable throughout the cabin of the aircraft.

(e) *Crash ax.* [Except for nontransport category airplanes type certificated after December 31, 1964, each airplane must be equipped with a crash ax.]

in the passenger cabin where it would be readily accessible to a normal flight attendant seat. However, the Administrator may grant a deviation from the requirements of this subparagraph if he finds that a different location would be more useful for evacuation of persons during an emergency.

(2) Two megaphones in the passenger cabin on each airplane with a seating capacity of more than 99 passengers, one installed at the forward end and the other at the most rearward location where it would be readily accessible to a normal flight attendant seat.

(Amdt. 121–2, Eff. 6/7/65); (Amdt. 121–20, Eff. 6/30/66); (Amdt. 121–30, Eff. 10/24/67); (Amdt. 121–48, Eff. 7/11/69); (Amdt. 121–106, Eff. 9/19/73); (Amdt. 121–185, Eff. 4/29/85); (Amdt. 121–188, Eff. 8/1/86); (Amdt 121–230, Eff. 10/15/92); (Amdt 121–242, Eff. 12/2/94); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.310 Additional emergency equipment.

(a) *Means for emergency evacuation.* Each passenger-carrying landplane emergency exit (other than over-the-wing) that is more than 6 feet from the ground with the airplane on the ground and the landing gear extended, must have an approved means to assist the occupants in descending to the ground. The assisting means for a floor level emergency exit must meet the requirements of § 25.809(f)(1) of this chapter in effect on April 30, 1972, except that, for any airplane for which the application for the type certificate was filed after that date, it must meet the requirements under which the airplane was type certificated. An assisting means that deploys automatically must be armed during taxiing, takeoffs, and landings. However, if the Administrator finds that the design of the exit makes compliance impractical, he may grant a deviation from the requirement of automatic deployment if the assisting means automatically erects upon deployment and, with respect to required emergency exits, if an emergency evacuation demonstration is conducted in accordance with § 121.291(a). This paragraph does not apply to the rear window emergency exit of DC–3 airplanes operated with less

conspicuously marked. The identity and location of each passenger emergency exit must be recognizable from a distance equal to the width of the cabin. The location of each passenger emergency exit must be indicated by a sign visible to occupants approaching along the main passenger aisle. There must be a locating sign—

(i) Above the aisle near each over-the-wing passenger emergency exit, or at another ceiling location if it is more practical because of low headroom;

(ii) Next to each floor level passenger emergency exit, except that one sign may serve two such exits if they both can be seen readily from that sign; and

(iii) On each bulkhead or divider that prevents fore and aft vision along the passenger cabin, to indicate emergency exits beyond and obscured by it, except that if this is not possible the sign may be placed at another appropriate location.

(2) Each passenger emergency exit marking and each locating sign must meet the following—

(i) [Except as provided in paragraph (b)(2)(iii) of this section,] for an airplane for which the application for the type certificate was filed prior to May 1, 1972, each passenger emergency exit marking and each locating sign must be manufactured to meet the requirements of § 25.812(b) of this chapter in effect on April 30, 1972. On these airplanes, no sign may continue to be used if its luminescence (brightness) decreases to below 100 microlamberts. The colors may be reversed if it increases the emergency illumination of the passenger compartment. However, the Administrator may authorize deviation from the two-inch background requirements if he finds that special circumstances exist that make compliance impractical and that the proposed deviation provides an equivalent level of safety.

(ii) [For a transport category airplane] for which the application for the type certificate was filed on or after May 1, 1972, each passenger emergency exit marking and each locating sign must be manufactured to meet the interior emergency exit marking requirements under which the airplane was type certificated.

must be manufactured to meet the requirements of § 23.811(b) of this chapter. On these airplanes, no sign may continue to be used if its luminescence (brightness) decreases to below 100 microlamberts.]

(c) *Lighting for interior emergency exit markings.* Except for nontransport category airplanes type certificated after December 31, 1964, each passenger-carrying airplane must have an emergency lighting system, independent of the main lighting system. However, sources of general cabin illumination may be common to both the emergency and the main lighting systems if the power supply to the emergency lighting system is independent of the power supply to the main lighting system. The emergency lighting system must—

(1) Illuminate each passenger exit marking and locating sign;

(2) Provide enough general lighting in the passenger cabin so that the average illumination when measured at 40-inch intervals at seat armrest height, on the centerline of the main passenger aisle, is at least 0.05 footcandles; and

(3) For airplanes type certificated after January 1, 1958, after November 26, 1986, include floor proximity emergency escape path marking which meets the requirements of § 25.812(e) of this chapter in effect on November 26, 1984.

(d) *Emergency light operation.* Except for lights forming part of emergency lighting subsystems provided in compliance with § 25.812(h) of this chapter (as prescribed in paragraph (h) of this section) that serve no more than one assist means, are independent of the airplane's main emergency lighting systems, and are automatically activated when the assist means is deployed, each light required by paragraphs (c) and (h) must comply with the following—

(1) Each light must—

(i) Be operable manually both from the flightcrew station and, for airplanes on which a flight attendant is required, from a point in the passenger compartment that is readily accessible to a normal flight attendant seat;

(ii) Have a means to prevent inadvertent operation of the manual controls; and

cal separation of the fuselage need not be considered.

(3) Each light must provide the required level of illumination for at least 10 minutes at the critical ambient conditions after emergency landing.

(4) Each light must have a cockpit control device that has an "on," "off," and "armed" position.

(e) *Emergency exit operating handles.*

(1) For a passenger-carrying airplane for which the application for the type certificate was filed prior to May 1, 1972, the location of each passenger emergency exit operating handle, and instructions for opening the exit, must be shown by a marking on or near the exit that is readable from a distance of 30 inches. In addition, for each Type I and Type II emergency exit with a locking mechanism released by rotary motion of the handle, the instructions for opening must be shown by—

(i) A red arrow with a shaft at least ¾ inch wide and a head twice the width of the shaft, extending along at least 70 degrees of arc at a radius approximately equal to ¾ of the handle length; and

(ii) The word "open" in red letters one inch high placed horizontally near the head of the arrow.

(2) For a passenger-carrying airplane for which the application for the type certificate was filed on or after May 1, 1972, the location of each passenger emergency exit operating handle and instructions for opening the exit must be shown in accordance with the requirements under which the airplane was type certificated. On these airplanes, no operating handle or operating handle cover may continue to be used if its luminescence (brightness) decreases to below 100 microlamberts.

(f) *Emergency exit access. Access to emergency exits must be provided as follows for each passenger-carrying transport category airplane:*

(1) Each passageway between individual passenger areas, or leading to a Type I or Type II emergency exit, must be unobstructed and at least 20 inches wide.

provisions of part 4b of the Civil Air Regulations in effect before December 20, 1951, if he finds that special circumstances exist that provide an equivalent level of safety.

(3) There must be access from the main aisle to each Type III and Type IV exit. The access from the aisle to these exits must not be obstructed by seats, berths, or other protrusions in a manner that would reduce the effectiveness of the exit. In addition—

(i) For an airplane for which the application for the type certificate was filed prior to May 1, 1972, the access must meet the requirements of § 25.813(c) of this chapter in effect on April 30, 1972; and

(ii) For an airplane for which the application for the type certificate was filed on or after May 1, 1972, the access must meet the emergency exit access requirements under which the airplane was certificated; except that—

(iii) After December 3, 1992, the access for an airplane type certificated after January 1, 1958, must meet the requirements of § 25.813(c) of this chapter, effective June 3, 1992.

(iv) Contrary provisions of this section notwithstanding, the Manager of the Transport Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, may authorize deviation from the requirements of paragraph (f)(3)(iii) of this section if it is determined that special circumstances make compliance impractical. Such special circumstances include, but are not limited to, the following conditions when they preclude achieving compliance with § 25.813(c)(1)(i) or (ii) without a reduction in the total number of passenger seats: emergency exits located in close proximity to each other; fixed installations such as lavatories, galleys, *etc.*; permanently mounted bulkheads; an insufficient number of seat rows ahead of or behind the exit to enable compliance without a reduction in the seat row pitch of more than one inch; or an insufficient number of such rows to enable compliance without a reduction in the seat row pitch to less than 30 inches. A request for such grant of deviation must outline the airplanes for which compliance will be achieved by December 3, 1992, and include a proposed schedule for incremental compliance of the remaining airplanes in the operator's fleet. In addition, the request must include credible reasons why compliance cannot be achieved earlier.

(4) If it is necessary to pass through a passageway between passenger compartments to reach any required emergency exit from any seat in the passenger cabin, the passageway must not be obstructed. However, curtains may be used if they allow free entry through the passageway.

(5) No door may be installed in any partition between passenger compartments.

(6) If it is necessary to pass through a doorway separating the passenger cabin from other areas to reach any required emergency exit from any passenger seat, the door must have a means to latch it in open position, and the door must be latched open during each takeoff and landing. The latching means must be able to withstand the loads imposed upon it when the door is subjected to the ultimate inertia forces, relative to the surrounding structure, listed in § 25.561(b) of this chapter.

(g) *Exterior exit markings.* Each passenger emergency exit and the means of opening that exit from the outside must be marked on the outside of the airplane. There must be a 2-inch colored band outlining each passenger emergency exit on the side of the fuselage. Each outside marking, including the band, must be readily distinguishable from the surrounding fuselage area by contrast in color.

The markings must comply with the following—

(1) If the reflectance of the darker color is 15 percent or less, the reflectance of the lighter color must be at least 45 percent.

(2) If the reflectance of the darker color is greater than 15 percent, at least a 30-percent difference between its reflectance and the reflectance of the lighter color must be provided.

marking to that effect must be provided on the other side. "Reflectance" is the ratio of the luminous flux reflected by a body to the luminous flux it receives.

(h) *Exterior emergency lighting and escape route.*

(1) Except for nontransport category airplanes certificated after December 31, 1964, each passenger-carrying airplane must be equipped with exterior lighting that meets the following requirements:

(i) For an airplane for which the application for the type certificate was filed prior to May 1, 1972, the requirements of § 25.812(f) and (g) of this chapter in effect on April 30, 1972.

(ii) For an airplane for which the application for the type certificate was filed on or after May 1, 1972, the exterior emergency lighting requirements under which the airplane was type certificated.

(2) Each passenger-carrying airplane must be equipped with a slip-resistant escape route that meets the following requirements—

(i) For an airplane for which the application for the type certificate was flied prior to May 1, 1972, the requirements of § 25.803(e) of this chapter in effect on April 30, 1972.

(ii) For an airplane for which the application for the type certificate was filed on or after May 1, 1972, the slip-resistant escape route requirements under which the airplane was type certificated.

(i) *Floor level exits.* Each floor level door or exit in the side of the fuselage (other than those leading into a cargo or baggage compartment that is not accessible from the passenger cabin) that is 44 or more inches high and 20 or more inches wide, but not wider than 46 inches, each passenger ventral exit (except the ventral exits on M–404 and CV–240 airplanes), and each tail cone exit, must meet the requirements of this section for floor level emergency exits. However, the Administrator may grant a deviation from this paragraph if he finds that circumstances make full compliance impractical and that an acceptable level of safety has been achieved.

(j) *Additional emergency exits.* Approved emergency exits in the passenger compartments that are in excess of the minimum number of required emergency exits must be—

(1) Openable from the inside without the use of a key or special tool; and

(2) Marked with a placard readable from a distance of 30 inches and installed at a conspicuous location near the means of opening the exit, stating that the exit has been designed and constructed so that it cannot be opened during flight.

(l) *Portable lights. No person may operate a passenger-carrying airplane unless it is equipped with flashlight stowage provisions accessible from each flight attendant seat.*

(m) Except as provided by § 121.627(c) and except for an airplane used in operations under this part on October 16, 1987, and having an emergency exit configuration installed and authorized for operation prior to October 16, 1987, for an airplane that is required to have more than one passenger emergency exit for each side of the fuselage, no passenger emergency exit shall be more than 60 feet from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the airplane's longitudinal axis between the nearest exit edges.

(Amdt. 121–2, Eff. 6/7/65); (Amdt. 121–20, Eff. 6/30/66); (Amdt. 121–30, Eff. 10/24/67); (Amdt. 121–35, Eff. 10/24/67); (Amdt. 121–38, Eff. 1/31/68); (Amdt. 121–41, Eff. 6/20/68); (Amdt. 121–45, Eff. 2/15/69); (Amdt. 121–46, Eff. 4/23/69); (Amdt. 121–47, Eff. 7/11/69); (Amdt. 121–77, Eff. 9/25/71); (Amdt. 121–84, Eff. 5/1/72); (Amdt. 121–99, Eff. 12/31/72); (Amdt. 121–149, Eff. 12/1/78); (Amdt. 121–183, Eff. 11/26/84); (Amdt. 121–205, Eff. 7/24/89); (Amdt. 121–228, Eff. 6/3/92); (Amdt. 121–251, Eff. 1/19/96); [(Amdt. 121–262, Eff. 3/12/97)]

§ 121.311 Seats, safety belts, and shoulder harnesses.

(a) No person may operate an airplane unless there are available during the takeoff, en route flight, and landing—

(1) An approved seat or berth for each person on board the airplane who has reached his second birthday; and

(2) An approved safety belt for separate use by each person on board the airplane who has reached his second birthday, except that two per-

or her during movement on the surface, takeoff, and landing. A safety belt provided for the occupant of a seat may not be used by more than one person who has reached his or her second birthday. Notwithstanding the preceding requirements, a child may—

(1) [Be held by an adult who is occupying an approved seat or berth, provided the child has not reached his or her second birthday and the child does not occupy or use any restraining device; or]

(2) Nothwithstanding any other requirement of this chapter, occupy an approved child restraint system furnished by the certificate holder or one of the persons described in paragraph (b)(2)(i) of this section, provided—

(i) The child is accompanied by a parent, guardian, or attendant designated by the child's parent or guardian to attend to the safety of the child during the flight;

(ii) [Except as provided in paragraph (b)(2)(ii)(D) of this section, the approved child restraint system bears one or more labels as follows:]

(A) Seats manufactured to U.S. standards between January 1, 1981, and February 25, 1985, must bear the label: ''This child restraint system conforms to all applicable Federal motor vehicle safety standards.''

(B) Seats manufactured to U.S. standards on or after February 26, 1985, must bear two labels—

(1) ''This child restraint system conforms to all applicable Federal motor vehicle safety standards''; and

(2) ''This restraint is certified for use in motor vehicles and aircraft'' in red lettering;

(C) Seats that do not qualify under paragraphs (b)(2)(ii)(A) and (b)(2)(ii)(B) of this section must bear either a label showing approval of a foreign government or a label showing that the seat was manufactured under the standards of the United Nations;

[(D) Notwithstanding any other provisions of this section, booster-type child restraint

(A) The restraint system must be properly secured to an approved forward-facing seat or berth;

(B) The child must be properly secured in the restraint system and must not exceed the specified weight limit for the restraint system; and

(C) The restraint system must bear the appropriate label(s).

(c) [Except as provided in paragraph (c)(3), the following prohibitions apply to certificate holders:

[(1) No certificate holder may permit a child, in an aircraft, to occupy a booster-type child restraint system, a vest-type child restraint system, a harness-type child restraint system, or a lap held child restraint system during take off, landing, and movement on the surface.

[(2) Except as required in paragraph (c)(1) of this section, no certificate holder may prohibit a child, if requested by the child's parent, guardian, or designated attendant, from occupying a child restraint system furnished by the child's parent, guardian, or designated attendant provided—

[(i) The child holds a ticket for an approved seat or berth or such seat or berth is otherwise made available by the certificate holder for the child's use;

[(ii) The requirements of paragraph (b)(2)(i) are met;

[(iii) The requirements of (b)(2)(iii) are met; and

[(iv) The child restraint system has one or more of the labels described in paragraph (b)(2)(ii)(A) through paragraph (b)(2)(ii)(C).

[(3) This section does not prohibit the certificate holder from providing child restraint systems authorized by this section or, consistent with safe operating practices, determining the most appropriate passenger seat location for the child restraint system.]

(d) Each sideward facing seat must comply with applicable requirements of § 25.785(c) of this chapter.

(e) Except as provided in paragraphs (e)(1) through (e)(3) of this section, no certificate holder

sit erect for a medical reason are carried in accordance with procedures in the certificate holder's manual if the seat back does not obstruct any passenger's access to the aisle or to any emergency exit.

(3) On airplanes with no flight attendant, the certificate holder may take off or land as long as the flightcrew instructs each passenger to place his or her seat back in the upright position for takeoff and landing.

(f) No person may operate a transport category airplane that was type certificated after January 1, 1958, or a nontransport category airplane manufactured after March 20, 1997, unless it is equipped at each flight deck station with a combined safety belt and shoulder harness that meets the applicable requirements specified in § 25.785 of this chapter, effective March 6, 1980, except that—

(1) Shoulder harnesses and combined safety belt and shoulder harnesses that were approved and installed before March 6, 1980, may continue to be used; and

(2) Safety belt and shoulder harness restraint systems may be designed to the inertia load factors established under the certification basis of the airplane.

(g) Each flight attendant must have a seat for takeoff and landing in the passenger compartment that meets the requirements of § 25.785 of this chapter, effective March 6, 1980, except that—

(1) Combined safety belt and shoulder harnesses that were approved and installed before March 6, 1980, may continue to be used; and

(2) Safety belt and shoulder harness restraint systems may be designed to the inertia load factors established under the certification basis of the airplane.

(3) The requirements of § 25.785(h) do not apply to passenger seats occupied by flight attendants not required by § 121.391.

(h) Each occupant of a seat equipped with a shoulder harness or with a combined safety belt and shoulder harness must have the shoulder harness or combined safety belt and shoulder harness properly secured about that occupant during takeoff and landing, except that a shoulder harness that is not combined with a safety belt may be unfas-

(Amdt. 121–30, Eff. 10/24/67); (Amdt. 121–41, Eff. 6/20/68); (Amdt. 121–75, Eff. 8/30/71); (Amdt. 121–84, Eff. 5/1/72); (Amdt. 121–133, Eff. 5/16/77); (Amdt. 121–155, Eff. 3/6/80); (Amdt. 121–157, Eff. 5/6/80); (Amdt. 121–170, Eff. 3/6/81); (Amdt. 121–177, Eff. 3/6/82); (Amdt 121–230, Eff. 10/15/92); (Amdt. 121–251, Eff. 1/19/96); [(Amdt. 121–255, Eff. 9/3/96)]

§ 121.312 Materials for compartment interiors.

[(a) *All interior materials; transport category airplanes and nontransport category airplanes type certificated before January 1, 1965.* Except for the materials covered by paragraph (b) of this section, all materials in each compartment of a transport category airplane, or a nontransport category airplane type certificated before January 1, 1965, used by the crewmembers and passengers, must meet the requirements of § 25.853 of this chapter in effect as follows, or later amendment thereto:

(1) *Airplane with passenger seating capacity of 20 or more.*

(i) *Manufactured after August 19, 1988, but prior to August 20, 1990.* Except as provided in paragraph (a)(3)(ii) of this section, each airplane with a passenger capacity of 20 or more and manufactured after August 19, 1988, but prior to August 20, 1990, must comply with the heat release rate testing provisions of § 25.853(d) in effect March 6, 1995 (formerly § 25.853(a–1) in effect on August 20, 1986) (see app. L of this part), except that the total heat release over the first 2 minutes of sample exposure must not exceed 100 kilowatt minutes per square meter and the peak heat release rate must not exceed 100 kilowatts per square meter.

(ii) *Manufactured after August 19, 1990.* Each airplane with a passenger capacity of 20 or more and manufactured after August 19, 1990, must comply with the heat release rate and smoke testing provisions of § 25.853(d) in effect March 6, 1995 (formerly § 25.853(a–1) (see app. L of this part) in effect on September 26, 1988).

filed prior to May 1, 1972, must comply with the provisions of § 25.853 in effect on April 30, 1972, regardless of passenger capacity, if there is a substantially complete replacement of the cabin interior after April 30, 1972.

(ii) *Airplane for which the application for type certificate was filed on or after May 1, 1972.* Except as provided in paragraph (a)(3)(i) or (a)(3)(ii) of this section, each airplane for which the application for type certificate was filed on or after May 1, 1972, must comply with the material requirements under which the airplane was type certificated, regardless of passenger capacity, if there is a substantially complete replacement of the cabin interior on or after that date.

(3) *Airplane type certificated after January 1, 1958, with passenger capacity of 20 or more.*

(i) *Substantially complete replacement of the cabin interior on or after March 6, 1995.* Except as provided in paragraph (a)(3)(ii) of this section, each airplane that was type certificated after January 1, 1958, and has a passenger capacity of 20 or more, must comply with the heat release rate testing provisions of § 25.853(d) in effect March 6, 1995 (formerly § 25.853(a–1) in effect on August 20, 1986) (see app. L of this part), if there is a substantially complete replacement of the cabin interior components identified in § 25.853(d), on or after that date, except that the total heat release over the first 2 minutes of sample exposure shall not exceed 100 kilowatt-minutes per square meter and the peak heat release rate must not exceed 100 kilowatts per square meter.

(ii) *Substantially complete replacement of the cabin interior on or after August 20, 1990.* Each airplane that was type certificated after January 1, 1958, and has a passenger capacity of 20 or more, must comply with the heat release rate and smoke testing provisions of § 25.853(d) in effect March 6, 1995 (formerly § 25.853(a–1) in effect on September 26, 1988) (see app. L of this part), if there is a substantially complete replacement of the cabin interior components identified in § 25.853(d), on or after August 20, 1990.

do not meet applicable flammability and smoke emission requirements, if the determination is made that special circumstances exist that make compliance impractical. Such grants of deviation will be limited to those airplanes manufactured within 1 year after the applicable date specified in this section and those airplanes in which the interior is replaced within 1 year of that date. A request for such grant of deviation must include a thorough and accurate analysis of each component subject to § 25.853(a–1), the steps being taken to achieve compliance, and, for the few components for which timely compliance will not be achieved, credible reasons for such noncompliance.

(5) Contrary provisions of this section notwithstanding, galley carts and galley standard containers that do not meet the flammability and smoke emission requirements of § 25.853(d) in effect March 6, 1995 (formerly § 25.853(a–1)) (see app. L of this part) may be used in airplanes that must meet the requirements of paragraphs (a)(1)(i), (a)(1)(ii), (a)(3)(i), or (a)(3)(ii) of this section, provided the galley carts or standard containers were manufactured prior to March 6, 1995.

[(b) *Seat cushions.* Seat cushions, except those on flight crewmember seats, in each compartment occupied by crew or passengers, must comply with the requirements pertaining to seat cushions in § 25.853(c) effective on November 26, 1984, on each airplane as follows:

(1) Each transport category airplane type certificated after January 1, 1958; and

(2) On or after December 20, 2010, each nontransport category airplane type certificated after December 31, 1964.

[(c) *All interior materials; airplanes type certificated in accordance with SFAR No. 41 of 14 CFR part 21.* No person may operate an airplane that conforms to an amended or supplemental type certificate issued in accordance with SFAR No. 41 of 14 CFR part 21 for a maximum certificated takeoff weight in excess of 12,500 pounds unless the airplane meets the compartment interior requirements set forth in § 25.853(a) in effect March 6, 1995 (formerly § 25.853(a), (b), (b–1), (b–2), and

passengers must meet the applicable requirement under which the airplane was type certificated.]

(Amdt. 121–30, Eff. 10/24/67); (Amdt. 121–84, Eff. 5/1/72); (Amdt. 121–184, Eff. 11/26/84); (Amdt. 121–189, Eff. 8/20/86); (Amdt. 121–198, Eff. 9/26/88); (Amdt. 121–247, Eff. 3/6/95); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.313 Miscellaneous equipment.

No person may conduct operation unless the following equipment is installed in the airplane—

(a) If protective fuses are installed on an airplane, the number of spare fuses approved for that airplane and appropriately described in the certificate holder's manual.

(b) A windshield wiper or equivalent for each pilot station.

(c) A power supply and distribution system that meets the requirements of §§ 25.1309, 25.1331, 25.1351(a) and (b)(1) through (4), 25.1353, 25.1355, and 25.1431(b) or that is able to produce and distribute the load for the required instruments and equipment, with use of an external power supply if any one power source or component of the power distribution system fails. The use of common elements in the system may be approved if the Administrator finds that they are designed to be reasonably protected against malfunctioning. Engine-driven sources of energy, when used, must be on separate engines.

(d) A means for indicating the adequacy of the power being supplied to required flight instruments.

(e) Two independent static pressure systems, vented to the outside atmospheric pressure so that they will be least affected by air flow variation or moisture or other foreign matter, and installed so as to be airtight except for the vent. When a means is provided for transferring an instrument from its primary operating system to an alternate system, the means must include a positive positioning control and must be marked to indicate clearly which system is being used.

(f) [A door between the passenger and pilot compartments, with a locking means to prevent passengers from opening it without the pilot's permission, except that nontransport category airplanes of access to a required passenger emergency exit, to indicate that it must be open during takeoff and landing.

(i) A means for the crew, in an emergency to unlock each door that leads to a compartment that is normally accessible to passengers and that can be locked by passengers.

(Amdt. 121–5, Eff. 4/30/65); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.314 Cargo and baggage compartments.

(a) [Each] Class C or D compartment, as defined in § 25.857 of part 25 of this chapter, greater than 200 cubic feet in volume in a transport category airplane type certificated after January 1, 1958, must have ceiling and sidewall liner panels which are constructed of—

(1) Glass fiber reinforced resin;

(2) Materials which meet the test requirements of part 25, appendix F, part III of this chapter; or

(3) In the case of liner installations approved prior to March 20, 1989, aluminum.

(b) For compliance with this section, the term "liner" includes any design feature, such as a joint or fastener, which would affect the capability of the liner to safely contain a fire.

Docket No. 25430 (54 FR 7389) Eff. 2/17/89

(Amdt. 121–202, Eff. 3/20/89); [(Amdt. 121–253, Eff. 2/26/96)]

§ 121.315 Cockpit check procedure.

(a) Each certificate holder shall provide an approved cockpit check procedure for each type of aircraft.

(b) The approved procedures must include each item necessary for flight crewmembers to check for safety before starting engines, taking off, or landing, and in engine and systems emergencies. The procedures must be designed so that a flight crewmember will not need to rely upon his memory for items to be checked.

requirements of § 25.963(e) of this Chapter in effect on October 30, 1989.

Docket No. 25614 (54 FR 40354) Eff. 9/29/89

(Amdt. 121–208, Eff. 10/30/89)

§ 121.317 Passenger information.

(a) Except as provided in paragraph (l) of this section, no person may operate an airplane unless it is equipped with passenger information signs that meet the requirements of § 25.791 of this chapter. Except as provided in paragraph (l) of this section, the signs must be constructed so that the crewmembers can turn them on and off.

(b) Except as provided in paragraph (l) of this section, the "Fasten Seat Belt" sign shall be turned on during any movement on the surface, for each takeoff, for each landing, and at any other time considered necessary by the pilot in command.

(c) No person may operate an aircraft on a flight segment on which smoking is prohibited unless the "No Smoking" passenger information signs are lighted during the entire flight segment, or one or more "No Smoking" placards meeting the requirements of § 25.1541 are posted during the entire flight segment. If both the lighted signs and the placards are used, the signs must remain lighted during the entire flight segment.

Smoking is prohibited on scheduled flight segments—

(1) Between any two points within Puerto Rico, the United States Virgin Islands, the District of Columbia, or any State of the United States (other than Alaska or Hawaii) or between any two points in any one of the above-mentioned jurisdictions (other than Alaska or Hawaii);

(2) Within the State of Alaska or within the State of Hawaii; or

(3) Scheduled in the current Worldwide or North American Edition of the *Official Airline Guide* for 6 hours or less in duration and between any point listed in paragraph (c)(1) of this section and any point in Alaska or Hawaii, or between any point in Alaska and any point in Hawaii.

(d) No person may operate a passenger-carrying airplane under this part unless at least one legible

of up to $2,000 for tampering with the smoke detector installed in this lavatory." These signs or placards need not meet the requirements of paragraph (a) of this section.

(f) Each passenger required by § 121.311(b) to occupy a seat or berth shall fasten his or her safety belt about him or her and keep it fastened while the "Fasten Seat Belt" sign is lighted.

(g) No person may smoke while a "No Smoking" sign is lighted or if "No Smoking" placards are posted, except that the pilot in command may authorize smoking on the flight deck except during airplane movement on the surface, takeoff, or landing.

(h) No person may smoke in any airplane lavatory.

(i) No person may tamper with, disable, or destroy any smoke detector installed in any airplane lavatory.

(j) On flight segments other than those described in paragraph (c) of this section, the "No Smoking" sign must be turned on during any movement on the surface, for each takeoff, for each landing, and at any other time considered necessary by the pilot in command.

(k) Each passenger shall comply with instructions given him or her by a crewmember regarding compliance with paragraphs (f), (g), (h), and (l) of this section.

(l) A certificate holder may operate a nontransport category airplane type certificated after December 31, 1964, that is manufactured before [December 20, 1997], if it is equipped with at least one placard that is legible to each person seated in the cabin that states "Fasten Seat Belt," and if, during any movement on the surface, for each takeoff, for each landing, and at any other time considered necessary by the pilot in command, a crewmember orally instructs the passengers to fasten their seat belts.

Docket No. 25590 (53 FR 12361) Eff. 4/13/88

(Amdt. 121–84, Eff. 5/1/72); (Amdt. 121–143, Eff. 6/26/78); (Amdt. 121–159, Eff. 8/31/80); (Amdt. 121–196, Eff. 4/23/88); (Amdt. 121–213, Eff. 2/25/90); (Amdt. 121–230, Eff. 10/15/92); (Amdt. 121–251, Eff. 1/19/96); [(Amdt. 121–256, Eff. 7/15/96)]

phones, selector switches, and signaling devices;

(b) Is approved in accordance with § 21.305 of this chapter;

(c) Is accessible for immediate use from each of two flight crewmember stations in the pilot compartment;

(d) For each required floor-level passenger emergency exit which has an adjacent flight attendant seat, has a microphone which is readily accessible to the seated flight attendant, except that one microphone may serve more than one exit, provided the proximity of the exits allows unassisted verbal communication between seated flight attendants;

(e) Is capable of operation within 10 seconds by a flight attendant at each of those stations in the passenger compartment from which its use is accessible;

(f) Is audible at all passenger seats, lavatories, and flight attendant seats and work stations; and

(g) For transport category airplanes manufactured on or after November 27, 1990, meets the requirements of § 25.1423 of this chapter.

Docket No. 24995 (54 FR 43926) Eff. 10/27/89

(Amdt. 121–105, Eff. 9/8/73); (Amdt. 121–149, Eff. 12/1/78); (Amdt. 121–159, Eff. 8/31/80); (Amdt. 121–179, Eff. 10/1/82); (Amdt. 121–209, Eff. 11/27/89)

§ 121.319 Crewmember interphone system.

(a) [No] person may operate an airplane with a seating capacity of more than 19 passengers unless the airplane is equipped with a crewmember interphone system that—

(1) Reserved

(2) Is capable of operation independent of the public address system required by § 121.318(a) except for handsets, headsets, microphones, selector switches, and signaling devices; and

(3) Meets the requirements of paragraph (b) of this section.

(b) The crewmember interphone system required by paragraph (a) of this section must be approved in accordance with § 21.305 of this chapter and meet the following requirements:

(1) It must be accessible for use from each of two flight crewmember stations in the pilot compartment;

(2) It must be accessible for use from each of two flight crewmember stations in the pilot compartment;

(3) It must be accessible for use from at least one normal flight attendant station in each passenger compartment;

(4) It must be capable of operation within 10 seconds by a flight attendant at those stations in each passenger compartment from which its use is accessible; and

(5) For large turbojet-powered airplanes—

(i) It must be accessible for use at enough flight attendant stations so that all floor-level emergency exits (or entryways to those exits in the case of exits located within galleys) in each passenger compartment are observable from one or more of those stations so equipped;

(ii) It must have an alerting system incorporating aural or visual signals for use by flight crewmembers to alert flight attendants and for use by flight attendants to alert flight crewmembers;

(iii) The alerting system required by paragraph (b)(5)(ii) of this section must have a means for the recipient of a call to determine whether it is a normal call or an emergency call; and

(iv) When the airplane is on the ground, it must provide a means of two-way communication between ground personnel and either of at least two flight crewmembers in the pilot compartment. The interphone system station for use by ground personnel must be so located that personnel using the system may avoid visible detection from within the airplane.

Docket No. 10865 (38 FR 21494) Eff. 8/9/73

(Amdt. 121–20, Eff. 6/30/66); (Amdt. 121–30, Eff. 10/24/67); (Amdt. 121–105, Eff. 9/8/73); (Amdt. 121–121, Eff. 9/8/75); (Amdt. 121–149, Eff. 12/1/78); (Amdt. 121–178, Eff. 4/28/82); [(Amdt. 121–253, Eff. 2/26/96)]

§ 121.321 [Reserved]

(Amdt. 121–3, Eff. 4/1/65); (Amdt. 121–155, Eff. 3/6/80)

(b) [An anti-collision light.

(c) [Two landing lights, except that only one landing light is required for nontransport category airplanes type certificated after December 31, 1964.]

(d) Instrument lights providing enough light to make each required instrument, switch, or similar instrument, easily readable and installed so that the direct rays are shielded from the flight crewmembers' eyes and that no objectionable reflections are visible to them. There must be a means of controlling the intensity of illumination unless it is shown that nondimming instrument lights are satisfactory.

(e) An airspeed-indicating system with heated pitot tube or equivalent means for preventing malfunctioning due to icing.

(f) A sensitive altimeter.

[(Amdt. 121–251, Eff. 1/19/96)]

§ 121.325 Instruments and equipment for operations under IFR or over-the-top.

No person may operate an airplane under IFR or over-the-top conditions unless it is equipped with the following instruments and equipment, in addition to those required by §§ 121.305 through 121.321—

(a) An airspeed indicating system with heated pitot tube or equivalent means for preventing malfunctioning due to icing.

(b) A sensitive altimeter.

(c) Instrument lights providing enough light to make each required instrument, switch, or similar instrument, easily readable and so installed that the direct rays are shielded from the flight crewmembers' eyes and that no objectionable reflections are visible to them, and a means of controlling the intensity of illumination unless it is shown that nondimming instrument lights are satisfactory.

(b) and (c) of this section. The amount of supplemental oxygen required for a particular operation is determined on the basis of flight altitudes and flight duration, consistent with the operation procedures established for each operation and route.

(b) *Crewmembers.*

(1) At cabin pressure altitudes above 10,000 feet up to and including 12,000 feet, oxygen must be provided for, and used by, each member of the flight crew on flight deck duty, and must be provided for other crewmembers, for that part of the flight at those altitudes that is of more than 30 minutes duration.

(2) At cabin pressure altitudes above 12,000 feet, oxygen must be provided for, and used by, each member of the flight crew on flight deck duty, and must be provided for other crewmembers, during the entire flight time at those altitudes.

(3) When a flight crewmember is required to use oxygen, he must use it continuously, except when necessary to remove the oxygen mask or other dispenser in connection with his regular duties. Standby crewmembers who are on call or are definitely going to have flight deck duty before completing the flight must be provided with an amount of supplemental oxygen equal to that provided for crewmembers on duty other than on flight deck duty. If a standby crewmember is not on call and will not be on flight deck duty during the remainder of the flight, he is considered to be a passenger for the purposes of supplemental oxygen requirements.

(c) *Passengers.* Each certificate holder shall provide a supply of oxygen, approved for passenger safety, in accordance with the following—

(1) For flights of more than 30 minutes duration at cabin pressure altitudes above 8,000 feet up to and including 14,000 feet, enough oxygen for 30 minutes for 10 percent of the passengers.

(2) For flights at cabin pressure altitudes above 14,000 feet up to and including 15,000 feet,

responding with the pressure in the cabin of the airplane, and "flight altitude" means the altitude above sea level at which the airplane is operated. For airplanes without pressurized cabins, "cabin pressure altitude" and "flight altitude" mean the same thing.

§ 121.329 Supplemental oxygen for sustenance: Turbine-engine-powered airplanes.

(a) *General.* When operating a turbine-engine-powered airplane, each certificate holder shall equip the airplane with sustaining oxygen and dispensing equipment for use as set forth in this section—

(1) The amount of oxygen provided must be at least the quantity necessary to comply with paragraphs (b) and (c) of this section.

(2) The amount of sustaining and first-aid oxygen required for a particular operation to comply with the rules in this part is determined on the basis of cabin pressure altitudes and flight duration, consistent with the operating procedures established for each operation and route.

(3) The requirements for airplanes with pressurized cabins are determined on the basis of cabin pressure altitude and the assumption that a cabin pressurization failure will occur at the altitude or point of flight that is most critical from the standpoint of oxygen need and that after the failure the airplane will descend in accordance with the emergency procedures specified in the Airplane Flight Manual, without exceeding its operating limitations, to a flight altitude that will allow successful termination of the flight.

(4) Following the failure, the cabin pressure altitude is considered to be the same as the flight altitude unless it is shown that no probable failure of the cabin or pressurization equipment will result in a cabin pressure altitude equal to the flight altitude. Under those circumstances, the maximum cabin pressure altitude attained may be used as a basis for certification or determination of oxygen supply, or both.

(b) *Crewmembers.* Each certificate holder shall provide a supply of oxygen for crewmembers in accordance with the following—

(2) At cabin pressure altitudes above 12,000 feet, oxygen must be provided for, and used by, each member of the flight crew on flight deck duty, and must be provided for other crewmembers during the entire flight at those altitudes.

(3) When a flight crewmember is required to use oxygen, he must use it continuously except when necessary to remove the oxygen mask or other dispenser in connection with his regular duties. Standby crewmembers who are on call or are definitely going to have flight deck duty before completing the flight must be provided with an amount of supplemental oxygen equal to that provided for crewmembers on duty other than on flight duty. If a standby crewmember is not on call and will not be on flight deck duty during the remainder of the flight he is considered to be a passenger for the purposes of supplemental oxygen requirements.

(c) *Passengers.* Each certificate holder shall provide a supply of oxygen for passengers in accordance with the following—

(1) For flights at cabin pressure altitudes above 10,000 feet, up to and including 14,000 feet, enough oxygen for that part of the flight at those altitudes that is of more than 30 minutes duration, for 10 percent of the passengers.

(2) For flights at cabin pressure altitudes above 14,000 feet, up to and including 15,000 feet, enough oxygen for that part of the flight at those altitudes for 30 percent of the passengers.

(3) For flights at cabin pressure altitudes above 15,000 feet, enough oxygen for each passenger carried during the entire flight at those altitudes.

§ 121.331 Supplemental oxygen requirements for pressurized cabin airplanes: Reciprocating-engine-powered airplanes.

(a) When operating a reciprocating-engine-powered airplane with a pressurized cabin, each certificate holder shall equip the airplane to comply with paragraphs (b) through (d) of this section in the event of cabin pressurization failure.

(b) *For crewmembers.* When operating at flight altitudes above 10,000 feet, the certificate holder

utes and followed by 110 minutes at 10,000 feet. The oxygen required by § 121.337 may be considered in determining the supplemental breathing supply required for flight crewmembers on flight deck duty in the event of cabin pressurization failure.

(c) *For passengers.* When operating at flight altitudes above 8,000 feet, the certificate holder shall provide oxygen as follows—

(1) When an airplane is not flown at a flight altitude above flight level 250, enough oxygen for 30 minutes for 10 percent of the passengers, if at any point along the route to be flown the airplane can safely descend to a flight altitude of 14,000 feet or less within four minutes.

(2) If the airplane cannot descend to a flight altitude of 14,000 feet or less within four minutes, the following supply of oxygen must be provided—

(i) For that part of the flight that is more than four minutes duration at flight altitudes above 15,000 feet, the supply required by § 121.327(c)(3).

(ii) For that part of the flight at flight altitudes above 14,000 feet, up to and including 15,000 feet, the supply required by § 121.327(c)(2).

(iii) For flight at flight altitudes above 8,000 feet up to and including 14,000 feet, enough oxygen for 30 minutes for 10 percent of the passengers.

(3) When an airplane is flown at a flight altitude above flight level 250, enough oxygen for 30 minutes for 10 percent of the passengers for the entire flight (including emergency descent) above 8,000 feet, up to and including 14,000 feet, and to comply with § 121.327(c)(2) and (3) for flight above 14,000 feet.

(d) For the purposes of this section it is assumed that the cabin pressurization failure occurs at a time during flight that is critical from the standpoint of oxygen need and that after the failure the airplane will descend, without exceeding its normal operating limitations, to flight altitudes allowing safe flight with respect to terrain clearance.

(Amdt. 121–132, Eff. 2/1/77)

equipment to comply with paragraphs (b) through (e) of this section in the event of cabin pressurization failure.

(b) *Crewmembers.* When operating at flight altitudes above 10,000 feet, the certificate holder shall supply enough oxygen to comply with § 121.329, but not less than a two-hour supply for each flight crewmember on flight deck duty. The required two hours supply is that quantity of oxygen necessary for a constant rate of descent from the airplane's maximum certificated operating altitude to 10,000 feet in ten minutes and followed by 110 minutes at 10,000 feet. The oxygen required in the event of cabin pressurization failure by § 121.337 may be included in determining the supply required for flight crewmembers on flight deck.

(c) *Use of oxygen masks by flight crewmembers.*

(1) When operating at flight altitudes above flight level 250, each flight crewmember on flight deck duty must be provided with an oxygen mask so designed that it can be rapidly placed on his face from its ready position, properly secured, sealed, and supplying oxygen upon demand; and so designed that after being placed on the face it does not prevent immediate communication between the flight crewmember and other crewmembers over the airplane intercommunication system. When it is not being used at flight altitudes above flight level 250, the oxygen mask must be kept in condition for ready use and located so as to be within the immediate reach of the flight crewmember while at his duty station.

(2) [When operating at flight altitudes above flight level 250, one pilot at the controls of the airplane shall at all times wear and use an oxygen mask secured, sealed, and supplying oxygen, in accordance with the following:

[(i) The one pilot need not wear and use an oxygen mask at or below the following flight levels if each flight crewmember on flight deck duty has a quick-donning type of oxygen mask that the certificate holder has shown can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand and within five seconds:

any required crewmember seat, and a payload capacity of 7,500 pounds or less, at or below flight level 350.

[(ii) Whenever a quick-donning type of oxygen mask is to be used under this section, the certificate holder shall also show that the mask can be put on without disturbing eye glasses and without delaying the flight crewmember from proceeding with his assigned emergency duties. The oxygen mask after being put on must not prevent immediate communication between the flight crewmember and other crewmembers over the airplane intercommunication system.]

(3) Notwithstanding paragraph (c)(2) of this section, if for any reason at any time it is necessary for one pilot to leave his station at the controls of the airplane when operating at flight altitudes above flight level 250, the remaining pilot at the controls shall put on and use his oxygen mask until the other pilot has returned to his duty station.

(4) Before the takeoff of a flight, each flight crewmember shall personally preflight his oxygen equipment to ensure that the oxygen mask is functioning, fitted properly, and connected to appropriate supply terminals, and that the oxygen supply and pressure are adequate for use.

(d) *Use of portable oxygen equipment by cabin attendants.* Each attendant shall, during flight above flight level 250 flight altitude, carry portable oxygen equipment with at least a 15-minute supply of oxygen unless it is shown that enough portable oxygen units with masks or spare outlets and masks are distributed throughout the cabin to ensure immediate availability of oxygen to each cabin attendant, regardless of his location at the time of cabin depressurization.

(e) *Passenger cabin occupants.* When the airplane is operating at flight altitudes above 10,000 feet, the following supply of oxygen must be provided for the use of passenger cabin occupants—

(1) When an airplane certificated to operate at flight altitudes up to and including flight level 250, can at any point along the route to be flown, descend safely to a flight altitude of 14,000 feet or less within four minutes, oxygen must be available at the rate prescribed by this part for level 250, oxygen must be available at the rate prescribed by this part for not less than 10 percent of the passenger cabin occupants for the entire flight after cabin depressurization, at cabin pressure altitudes above 10,000 feet up to and including 14,000 feet and, as applicable, to allow compliance with § 121.329(c)(2) and (3), except that there must be not less than a 10-minute supply for the passenger cabin occupants.

(3) For first aid treatment of occupants who for physiological reasons might require undiluted oxygen following descent from cabin pressure altitudes above flight level 250, a supply of oxygen in accordance with the requirements of § 25.1443(d) must be provided for two percent of the occupants for the entire flight after cabin depressurization at cabin pressure altitudes above 8,000 feet, but in no case to less than one person. An appropriate number of acceptable dispensing units, but in no case less than two, must be provided, with a means for the cabin attendants to use this supply.

(f) *Passenger briefing.* Before flight is conducted above flight level 250, a crewmember shall instruct the passengers on the necessity of using oxygen in the event of cabin depressurization and shall point out to them the location and demonstrate the use of the oxygen-dispensing equipment.

(Amdt. 121–11, Eff. 9/30/65); (Amdt. 121–132, Eff. 2/1/77); [(Amdt. 121–262, Eff. 3/12/97)]

§ 121.335 Equipment standards.

(a) *Reciprocating-engine-powered airplanes.* The oxygen apparatus, the minimum rates of oxygen flow, and the supply of oxygen necessary to comply with § 121.327 must meet the standards established in § 4b.651 of the Civil Air Regulations as in effect on July 20, 1950, except that if the certificate holder shows full compliance with those standards to be impracticable, the Administrator may authorize any change in those standards that he finds will provide an equivalent level of safety.

(b) *Turbine-engine-powered airplanes.* The oxygen apparatus, the minimum rate of oxygen flow, and the supply of oxygen necessary to comply with §§ 121.329 and 121.333 must meet the standards established in § 4b.651 of the Civil Air Regula-

§ 121.337 Protective breathing equipment.

(a) The certificate holder shall furnish approved protective breathing equipment (PBE) meeting the equipment, breathing gas, and communication requirements contained in paragraph (b) of this section.

(b) *Pressurized and nonpressurized cabin airplanes.* Except as provided in paragraph (f) of this section, no person may operate an airplane unless protective breathing equipment meeting the requirements of this section is provided as follows—

(1) *General.* The equipment must protect the flightcrew from the effects of smoke, carbon dioxide or other harmful gases or an oxygen deficient environment caused by other than an airplane depressurization while on flight deck duty and must protect crewmembers from the above effects while combatting fires on board the airplane.

(2) The equipment must be inspected regularly in accordance with inspection guidelines and the inspection periods established by the equipment manufacturer to ensure its condition for continued serviceability and immediate readiness to perform its intended emergency purposes. The inspection periods may be changed upon a showing by the certificate holder that the changes would provide an equivalent level of safety.

(3) That part of the equipment protecting the eyes must not impair the wearer's vision to the extent that a crewmember's duties cannot be accomplished and must allow corrective glasses to be worn without impairment of vision or loss of the protection required by paragraph (b)(1) of this section.

(4) The equipment, while in use, must allow the flightcrew to communicate using the airplane radio equipment and to communicate by interphone with each other while at their assigned duty stations. The equipment, while in use, must also allow crewmember interphone communications between each of two flight crewmember stations in the pilot compartment and at least one normal flight attendant station in each passenger compartment.

(5) The equipment, while in use, must allow any crewmember to use the airplane interphone ply system equipment requirements are as follows—

(i) The equipment must supply breathing gas for 15 minutes at a pressure altitude of 8,000 feet for the following:

(A) Flight crewmembers while performing flight deck duties;

(B) Crewmembers while combatting an in-flight fire.

(ii) The breathing gas system must be free from hazards in itself, in its method of operation, and in its effect upon other components.

(iii) [For breathing gas systems other than chemical oxygen generators, there must be a means to allow the crew to readily determine, during the equipment preflight described in paragraph (c) of this section, that the gas supply is fully charged.]

(iv) For each chemical oxygen generator, the supply system equipment must meet the requirements of § 25.1450(b) and (c) of this chapter.

(8) Smoke and fume protection. Protective breathing equipment with a fixed or portable breathing gas supply meeting the requirements of this section must be conveniently located on the flight deck and be easily accessible for immediate use by each required flight crewmember at his or her assigned duty station.

(9) Fire combatting. Except for nontransport category airplanes type certificated after December 31, 1964, protective breathing equipment with a portable breathing gas supply meeting the requirements of this section must be easily accessible and conveniently located for immediate use by crewmembers in combatting fires as follows:

([i]) One PBE is required for each hand fire extinguisher located for use in a galley other than a galley located in a passenger, cargo, or crew compartment.

([ii]) One on the flight deck, except that the Administrator may authorize another location for this PBE if special circumstances exist that make compliance impractical and the proposed deviation would provide an equivalent level of safety.

locations if special circumstances exist that make compliance impractical and if the proposed deviation provides an equivalent level of safety.]

(c) *Equipment preflight.*

(1) Before each flight, each item of PBE at flight crewmember duty stations must be checked by the flight crewmember who will use the equipment to ensure that the equipment—

(i) For other than chemical oxygen generator systems, is functioning, is serviceable, fits properly (unless a universal-fit type), and is connected to supply terminals and that the breathing gas supply and pressure are adequate for use; and

(ii) For chemical oxygen generator systems, is serviceable and fits properly (unless a universal-fit type).

(2) Each item of PBE located at other than a flight crewmember duty station must be checked by a designated crewmember to ensure that each is properly stowed and serviceable, and, for other than chemical oxygen generator systems, the breathing gas supply is fully charged. Each certificate holder, in its operations manual, must designate at least one crewmember to perform those checks before he or she takes off in that airplane for his or her first flight of the day.

Docket No. 24792 (52 FR 20957) Eff. 6/3/87;

(Amdt. 121–193, Eff. 7/6/87); (Amdt. 121–204, Eff. 5/22/89); (Amdt. 121–212, Eff. 2/15/90); (Amdt. 121–218, Eff. 7/30/90); (Amdt. 121–230, Eff. 10/15/92); (Amdt. 121–251, Eff. 1/19/96); [(Amdt. 121–261, Eff. 9/25/96)]

§ 121.339 Emergency equipment for extended over-water operations.

(a) Except where the Administrator, by amending the operations specifications of the certificate holder, requires the carriage of all or any specific items of the equipment listed below for any over-water operation, or upon application of the certificate holder, the Administrator allows deviation for a particular extended over-water operation, no person may operate an airplane in extended over-water

ity and buoyancy to accommodate the occupants of the airplane. Unless excess rafts of enough capacity are provided, the buoyancy and seating capacity of the rafts must accommodate all occupants of the airplane in the event of a loss of one raft of the largest rated capacity.

(3) At least one pyrotechnic signaling device for each life raft.

(4) [An approved survival type emergency locator transmitter. Batteries used in this transmitter must be replaced (or recharged, if the battery is rechargeable) when the transmitter has been in use for more than 1 cumulative hour, or, when 50 percent of their useful life (or for rechargeable batteries, 50 percent of their useful life of charge) has expired, as established by the transmitter manufacturer under its approval. The new expiration date for replacing (or recharging) the battery must be legibly marked on the outside of the transmitter. The battery useful life (or useful life of charge)(requirements of this paragraph do not apply to batteries (such as water-activated batteries) that are essentially unaffected during probable storage intervals.]

(b) The required life rafts, life preservers, and survival type emergency locator transmitter must be easily accessible in the event of a ditching without appreciable time for preparatory procedures. This equipment must be installed in conspicuously marked, approved locations.

(c) A survival kit, appropriately equipped for the route to be flown, must be attached to each required liferaft.

(Amdt. 121–25, Eff. 2/28/67); (Amdt. 121–53, Eff. 10/30/69); (Amdt. 121–79, Eff. 10/21/71); (Amdt. 121–93, Eff. 7/19/72); (Amdt. 121–106, Eff. 9/19/73); (Amdt. 121–149, Eff. 12/1/78); (Amdt. 121–158, Eff. 9/9/80); [(Amdt. 121–239, Eff. 6/21/94)]

§ 121.340 Emergency flotation means.

(a) [Except as provided in paragraph (b) of this section, no person may operate an airplane in any overwater operation unless it is equipped with life preservers in accordance with § 121.339(a)(1) or with an approved flotation means for each occupant. This means must be within easy reach of each

air carrier or commercial operator shows that the water over which the airplane is to be operated is not such size and depth that life preservers or flotation means would be required for the survival of its occupants in the event the flight terminates in that water.

Docket No. 6713 (31 FR 1147) Eff. 1/28/66

(Amdt. 121–17, Eff. 2/27/66); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.341 Equipment for operations in icing conditions.

(a) [Except as permitted in paragraph (c)(2) of this section, unless an airplane is type certificated under the transport category airworthiness requirements relating to ice protection, or unless an airplane is a nontransport category airplane type certificated after December 31, 1964, that has the ice protection provisions that meet section 34 of appendix A of part 135 of this chapter, no person may operate an airplane in icing conditions unless it is equipped with means for the prevention or removal of ice on windshields, wings, empennage, propellers, and other parts of the airplane where ice formation will adversely affect the safety of the airplane.]

(b) No person may operate an airplane in icing conditions at night unless means are provided for illuminating or otherwise determining the formation of ice on the parts of the wings that are critical from the standpoint of ice accumulation. Any illuminating that is used must be of a type that will not cause glare or reflection that would handicap crewmembers in the performance of their duties.

[(c) *Nontransport category airplanes type certificated after December 31, 1964.* Except for an airplane that has ice protection provisions that meet section 34 of appendix A of part 135 of this chapter, or those for transport category airplane type certification, no person may operate—

(1) Under IFR into known or forecast light or moderate icing conditions;

(2) Under VFR into known light or moderate icing conditions; unless the airplane has functioning deicing anti-icing equipment protecting each propeller, windshield, wing, stabilizing or control otherwise prohibit the flight will not be encountered during the flight because of changed weather conditions since the forecast, the restrictions in paragraph (c) of this section based on forecast conditions do not apply.]

[(Amdt. 121–251, Eff. 1/19/96)]

§ 121.342 Pitot heat indication systems.

[No person may operate a transport category airplane or, after December 20, 1999, a nontransport category airplane type certificated after December 31, 1964, that is equipped with a flight instrument pitot heating system unless the airplane is also equipped with an operable pitot heat indication system that complies with § 25.1326 of this chapter in effect on April 12, 1978.]

(Amdt. 121–175, Eff. 9/30/81); (Amdt. 121–207, Eff. 10/25/89); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.343 Flight recorders.

(a) Except as provided in paragraphs (b), (c), (d), (e) and (f) of this section, no person may operate a large airplane that is certificated for operations above 25,000 feet altitude or is turbine-engine-powered unless it is equipped with one or more approved flight recorders that record data from which the following may be determined within the ranges, accuracies, and recording intervals specified in appendix B of this part—

(1) Time;

(2) Altitude;

(3) Airspeed;

(4) Vertical acceleration;

(5) Heading; and

(6) Time of each radio transmission either to or from air traffic control.

(b) No person may operate a large airplane type certificated up to and including September 30, 1969, for operations above 25,000 feet altitude, or a turbine-engine-powered airplane certificated before the same date, unless it is equipped before May 26, 1989, with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The following information must be able to be determined within the

(6) Time of each radio transmission either to or from air traffic control.

(c) [Except as provided in paragraph (l) of this section, no person may operate an airplane specified in paragraph (b) of this section unless it is equipped, before May 26, 1994, with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium.] The following information must be able to be determined within the ranges, accuracies and recording intervals specified in appendix B of this part—

(1) Time;

(2) Altitude;

(3) Airspeed;

(4) Vertical acceleration;

(5) Heading;

(6) Time of each radio transmission either to or from air traffic control;

(7) Pitch attitude;

(8) Roll attitude;

(9) Longitudinal acceleration;

(10) Control column or pitch control surface position; and

(11) Thrust of each engine.

(d) No person may operate an airplane specified in paragraph (b) of this section that is manufactured after May 26, 1989, as well as airplanes specified in paragraph (a) of this section that have been type certificated after September 30, 1969, unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The following information must be able to be determined within the ranges, accuracies, and recording intervals specified in appendix B of this part—

(1) Time;

(2) Altitude;

(3) Airspeed;

(4) Vertical acceleration;

(5) Heading;

(6) Time of each radio transmission either to or from air traffic control;

(7) Pitch attitude;

(8) Roll attitude;

(9) Longitudinal acceleration;

(10) Control column or pitch control surface position;

(11) Thrust of each engine;

(12) Lateral acceleration;

(13) Rudder pedal or yaw control surface position;

(14) Thrust of each engine;

(15) Position of each thrust reverser;

(16) Trailing edge flap or cockpit flap control position; and

(17) Leading edge flap of cockpit flap control position.

For the purpose of this section, ''manufactured'' means the point in time at which the airplane inspection acceptance records reflect that the airplane is complete and meets the FAA approved type design data.

(e) After October 11, 1991, no person may operate a large airplane equipped with a digital data bus and ARINC 717 digital flight data acquisition unit (DFDAU) or equivalent unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. Any parameters specified in appendix B of this part that are available on the digital data bus must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified.

(f) After October 11, 1991, no person may operate an airplane specified in paragraph (b) of this section that is manufactured after October 11, 1991, nor an airplane specified in paragraph (a) of this section that has been type certificated after September 30, 1969, and manufactured after October 11, 1991, unless it is equipped with one or more flight recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The parameters specified in appendix B of the part must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified.

(g) Whenever a flight recorder required by this section is installed, it must be operated continuously from the instant the airplane begins the takeoff roll until it has completed the landing roll at an airport.

(h) Except as provided in paragraph (g) of this section, and except for recorded data erased as authorized in this paragraph, each certificate holder shall keep the recorded data prescribed in paragraph (a), (b), (c), or (d) of this section, as appropriate,

of testing. Except as provided in paragraph (g) of this section, no record need be kept more than 60 days.

(i) In the event of an accident or occurrence that requires immediate notification of the National Transportation Safety Board under part 830 of its regulations and that results in termination of the flight, the certificate holder shall remove the recording media from the airplane and keep the recorded data required by paragraph (a), (b), (c), or (d) of this section, as appropriate, for at least 60 days or for a longer period upon the request of the Board or the Administrator.

(j) Each flight recorder required by this section must be installed in accordance with the requirements of § 25.1459 of this chapter in effect on August 31, 1977. The correlation required by § 25.1459(c) of this chapter need be established only on one airplane of any group of airplanes—

(1) That are of the same type;

(2) On which the model flight recorder and its installation are the same; and

(3) On which there is no difference in the type design with respect to the installation of those first pilot's instruments associated with the flight recorder. The most recent instrument calibration, including the recording medium from which this calibration is derived, and the recorder correlation must be retained by the certificate holder.

(k) Each flight recorder required by this section that records the data specified in paragraph (a), (b), (c), or (d) of this section, as appropriate, must have an approved device to assist in locating that recorder under water.

[(l) No person may operate an airplane specified in paragraph (b) of this section that meets the Stage 2 noise levels of part 36 of this chapter and is subject to § 91.801(c) of this chapter unless it is equipped with one or more approved flight data recorders that utilize a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The information specified in paragraphs (c)(1) through (c)(11) of this section must be able to be determined within the ranges, accuracies and recording intervals specified in appendix B of this part. In addition—

mit to the FAA Flight Standards Service, Air Transportation Division (AFS–200), documentation listing those airplanes covered under this paragraph and evidence that it has ordered a sufficient number of flight data recorders to meet the May 26, 1995, compliance date for all aircraft on that list.

[(3) After May 26, 1994, any aircraft that is modified to meet Stage 3 noise levels must have the flight data recorder described in paragraph (c) of this section installed before operating under this part.]

Docket No. 24418 (52 FR 9636) Eff. 3/25/87

(Amdt. 121–15, Eff. 2/5/66); (Amdt. 121–29, Eff. 6/22/67); (Amdt. 121–37, Eff. 12/14/67); (Amdt. 121–66, Eff. 9/18/70); (Amdt. 121–82, Eff. 1/10/72); (Amdt. 121–130, Eff. 11/26/76); (Amdt. 121–135, Eff. 9/1/77); (Amdt. 121–143, Eff. 6/26/78); (Amdt. 121–191, Eff. 5/26/87); (Amdt. 121–197, Eff. 10/11/88); [(Amdt. 121–238, Eff. 5/24/94)]

§ 121.344 [Digital flight data recorders for transport category airplanes.

[(a) Except as provided in paragraph (l) of this section, no person may operate under this part a turbine-engine-powered transport category airplane unless it is equipped with one or more approved flight recorders that use a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. The operational parameters required to be recorded by digital flight data recorders required by this section are as follows:

The phrase "when an information source is installed" following a parameter indicates that recording of that parameter is not intended to require a change in installed equipment:

(1) Time;

(2) Pressure altitude;

(3) Indicated airspeed;

(4) Heading—primary flight crew reference (if selectable, record discrete, true or magnetic);

(5) Normal acceleration (Vertical);

(6) Pitch attitude;

(7) Roll attitude;

(13) Lateral control input;

(14) Rudder pedal input;

(15) Primary pitch control surface position;

(16) Primary lateral control surface position;

(17) Primary yaw control surface position;

(18) Lateral acceleration;

(19) Pitch trim surface position or parameters of paragraph (a)(82) of this section if currently recorded;

(20) Trailing edge flap or cockpit flap control selection (except when parameters of paragraph (a)(85) of this section apply);

(21) Leading edge flap or cockpit flap control selection (except when parameters of paragraph (a)(86) of this section apply);

(22) Each Thrust reverser position (or equivalent for propeller airplane);

(23) Ground spoiler position or speed brake selection (except when parameters of paragraph (a)(87) of this section apply);

(24) Outside or total air temperature;

(25) Automatic Flight Control System (AFCS) modes and engagement status, including autothrottle;

(26) Radio altitude (when an information source is installed);

(27) Localizer deviation, MLS Azimuth;

(28) Glideslope deviation, MLS Elevation;

(29) Marker beacon passage;

(30) Master warning;

(31) Air/ground sensor (primary airplane system reference nose or main gear);

(32) Angle of attack (when information source is installed);

(33) Hydraulic pressure low (each system);

(34) Ground speed (when an information source is installed);

(35) Ground proximity warning system;

(36) Landing gear position or landing gear cockpit control selection;

(37) Drift angle (when an information source is installed);

(38) Wind speed and direction (when an information source is installed);

(39) Latitude and longitude (when an information source is installed);

(44) Traffic alert and collision avoidance system;

(45) DME 1 and 2 distances;

(46) Nav 1 and 2 selected frequency;

(47) Selected barometric setting (when an information source is installed);

(48) Selected altitude (when an information source is installed);

(49) Selected speed (when an information source is installed);

(50) Selected mach (when an information source is installed);

(51) Selected vertical speed (when an information source is installed);

(52) Selected heading (when an information source is installed);

(53) Selected flight path (when an information source is installed);

(54) Selected decision height (when an information source is installed);

(55) EFIS display format;

(56) Multi-function/engine/alerts display format;

(57) Thrust command (when an information source is installed);

(58) Thrust target (when an information source is installed);

(59) Fuel quantity in CG trim tank (when an information source is installed);

(60) Primary Navigation System Reference;

(61) Icing (when an information source is installed);

(62) Engine warning each engine vibration (when an information source is installed);

(63) Engine warning each engine over temp. (when an information source is installed);

(64) Engine warning each engine oil pressure low (when an information source is installed);

(65) Engine warning each engine over speed (when an information source is installed);

(66) Yaw trim surface position;

(67) Roll trim surface position;

(68) Brake pressure (selected system);

(69) Brake pedal application (left and right);

(70) Yaw or sideslip angle (when an information source is installed);

(75) DC electrical bus status;

(76) APU bleed valve position (when an information source is installed);

(77) Hydraulic pressure (each system);

(78) Loss of cabin pressure;

(79) Computer failure;

(80) Heads-up display (when an information source is installed);

(81) Para-visual display (when an information source is installed);

(82) Cockpit trim control input position—pitch;

(83) Cockpit trim control input position—roll;

(84) Cockpit trim control input position—yaw;

(85) Trailing edge flap and cockpit flap control position;

(86) Leading edge flap and cockpit flap control position;

(87) Ground spoiler position and speed brake selection; and

(88) All cockpit flight control input forces (control wheel, control column, rudder pedal).

[(b) For all turbine-engine-powered transport category airplanes manufactured on or before October 11, 1991, by August 20, 2001.

(1) For airplanes not equipped as of July 16, 1996, with a flight data acquisition unit (FDAU), the parameters listed in paragraphs (a)(1) through (a)(18) of this section must be recorded within the ranges and accuracies specified in Appendix B of this part, and—

(i) For airplanes with more than two engines, the parameter described in paragraph (a)(18) is not required unless sufficient capacity is available on the existing recorder to record that parameter;

(ii) Parameters listed in paragraphs (a)(12) through (a)(17) each may be recorded from a single source.

(2) For airplanes that were equipped as of July 16, 1996, with a flight data acquisition unit (FDAU), the parameters listed in paragraphs (a)(1) through (a)(22) of this section must be recorded within the ranges, accuracies, and recording intervals specified in Appendix M of this part. Parameters listed in paragraphs (a)(12) through (a)(14) each may be recorded from a single source.

(3) That were subject to § 121.343(e) of this part, all conditions of § 121.343(e) must continue to be met until compliance with paragraph (b)(1) of this section is accomplished.

[(c) For all turbine-engine-powered transport category airplanes manufactured on or before October 11, 1991—

(1) That were equipped as of July 16, 1996, with one or more digital data bus(es) and an ARINC 717 digital flight data acquisition unit (DFDAU) or equivalent, the parameters specified in paragraphs (a)(1) through (a)(22) of this section must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix M of this part by August 20, 2001. Parameters listed in paragraphs (a)(12) through (a)(14) each may be recorded from a single source.

(2) Commensurate with the capacity of the recording system (DFDAU or equivalent and the DFDR), all additional parameters for which information sources are installed and which are connected to the recording system must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix M of this part by August 20, 2001.

(3) That were subject to § 121.343(e) of this part, all conditions of § 121.343(e) must continue to be met until compliance with paragraph (c)(1) of this section is accomplished.

[(d) For all turbine-engine-powered transport category airplanes that were manufactured after October 11, 1991—

(1) The parameters listed in paragraphs (a)(1) through (a)(34) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix M of this part by August 20, 2001. Parameters listed in paragraphs (a)(12) through (a)(14) each may be recorded from a single source.

(2) Commensurate with the capacity of the recording system, all additional parameters for which information sources are installed and which are connected to the recording system must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix M of this part by August 20, 2001.

(2) Commensurate with the capacity of the recording system, all additional parameters for which information sources are installed and which are connected to the recording system, must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix M of this part.

[(f) For all turbine-engine-powered transport category airplanes that are manufactured after August 19, 2002, the parameters listed in paragraphs (a)(1) through (a)(88) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix M of this part.

[(g) Whenever a flight data recorder required by this section is installed, it must be operated continuously from the instant the airplane begins its takeoff roll until it has completed its landing roll.

[(h) Except as provided in paragraph (i) of this section, and except for recorded data erased as authorized in this paragraph, each certificate holder shall keep the recorded data prescribed by this section, as appropriate, until the airplane has been operated for at least 25 hours of the operating time specified in § 121.359(a) of this part. A total of 1 hour of recorded data may be erased for the purpose of testing the flight recorder or the flight recorder system. Any erasure made in accordance with this paragraph must be of the oldest recorded data accumulated at the time of testing. Except as provided in paragraph (i) of this section, no record need be kept more than 60 days.

[(i) In the event of an accident or occurrence that requires immediate notification of the National Transportation Safety Board under 49 CFR 830 of its regulations and that results in termination of the flight, the certificate holder shall remove the recorder from the airplane and keep the recorder data prescribed by this section, as appropriate, for at least 60 days or for a longer period upon the request of the Board or the Administrator.

[(j) Each flight data recorder system required by this section must be installed in accordance with the requirements of § 25.1459(a), (b), (d), and (e) of this chapter. A correlation must be established part of the flight data recorder system, a single correlation may be established for any group of airplanes—

(1) That are of the same type;

(2) On which the flight recorder system and its installation are the same; and

(3) On which there is no difference in the type design with respect to the installation of those sensors associated with the flight data recorder system. Documentation sufficient to convert recorded data into the engineering units and discrete values specified in the applicable appendix must be maintained by the certificate holder.

[(k) Each flight data recorder required by this section must have an approved device to assist in locating that recorder under water.

[(l) The following airplanes that were manufactured before August 18, 1997 need not comply with this section, but must continue to comply with applicable paragraphs of § 121.343 of this chapter, as appropriate:

(1) Airplanes that meet the Stage 2 noise levels of part 36 of this chapter and are subject to § 91.801(c) of this chapter, until January 1, 2000. On and after January 1, 2000, any Stage 2 airplane otherwise allowed to be operated under Part 91 of this chapter must comply with the applicable flight data recorder requirements of this section for that airplane.

(2) General Dynamics Convair 580, General Dynamics Convair 600, General Dynamics Convair 640, deHavilland Aircraft Company Ltd. DHC–7, Fairchild Industries FH 227, Fokker F–27 (except Mark 50), F–28 Mark 1000 and Mark 4000, Gulfstream Aerospace G–159, Lockheed Aircraft Corporation Electra 10–A, Lockheed Aircraft Corporation Electra 10–B, Lockheed Aircraft Corporation Electra 10–E, Lockheed Aircraft Corporation Electra L–188, Maryland Air Industries, Inc. F27, Mitsubishi Heavy Industries, Ltd. YS–11, Short Bros. Limited SD3–30, Short Bros. Limited SD3–60.]

(Amdt. 121–251, Eff. 1/19/96); [(Amdt. 121–266, Eff. 8/18/97)]

onto the U.S. register after, or was registered outside the United States and added to the operator's U.S. operations specifications after, October 11, 1991, unless it is equipped with one or more approved flight recorders that use a digital method of recording and storing data and a method of readily retrieving that data from the storage medium. On or before August 20, 2001, airplanes brought onto the U.S. register after October 11, 1991, must comply with either the requirements in this section or the applicable paragraphs in § 135.152 of this chapter. In addition, by August 20, 2001—

(1) The parameters listed in §§ 121.344(a)(1) through 121.344(a)(11) of this part must be recorded with the ranges, accuracies, and resolutions specified in Appendix B of part 135 of this chapter, except that—

(i) Either the parameter listed in § 121.344 (a)(12) or (a)(15) of this part must be recorded; either the parameters listed in § 121.344(a)(13) or (a)(16) of this part must be recorded; and either the parameter listed in § 121.344(a)(14) or (a)(17) of this part must be recorded.

(ii) For airplanes with more than two engines, the parameter described in § 121.344(a)(18) of this part must also be recorded if sufficient capacity is available on the existing recorder to record that parameter;

(iii) Parameters listed in §§ 121.344(a)(12) through 121.344(a)(17) of this part each may be recorded from a single source;

(iv) Any parameter for which no value is contained in Appendix B of part 135 of this chapter must be recorded within the ranges, accuracies, and resolutions specified in Appendix M of this part.

(2) Commensurate with the capacity of the recording system (FDAU or equivalent and the DFDR), the parameters listed in §§ 121.344(a)(19) through 121.344(a)(22) of this part also must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix B of part 135 of this chapter.

(3) The approved flight recorder required by this section must be installed as soon as practicable, but no later than the next heavy maintenance check after August 20, 2001.

[(b) For all turbine-engine-powered airplanes having a passenger seating configuration, excluding any required crewmember seat, of 10 to 19 seats, that are manufactured after August 18, 2000—

(1) The parameters listed in §§ 121.344(a)(1) through 121.344(a)(57) of this part, must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix M of this part.

(2) Commensurate with the capacity of the recording system, all additional parameters listed in § 121.344(a) of this part for which information sources are installed and which are connected to the recording system, must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix M of this part by August 20, 2001.

[(c) For all turbine-engine-powered airplanes having a passenger seating configuration, excluding any required crewmember seats, of 10 to 19 seats, that are manufactured after August 19, 2002, the parameters listed in § 121.344(a)(1) through (a)(88) of this part must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix M of this part.

[(d) Each flight data recorder system required by this section must be installed in accordance with the requirements of § 23.1459(a), (b), (d), and (e) of this chapter. A correlation must be established between the values recorded by the flight data recorder and the corresponding values being measured. The correlation must contain a sufficient number of correlation points to accurately establish the conversion from the recorded values to engineering units or discrete state over the full operating range of the parameter. A single correlation may be established for any group of airplanes—

(1) That are of the same type;

(2) On which the flight recorder system and its installation are the same; and

(3) On which there is no difference in the type design with respect to the installation of those sensors associated with the flight data recorder system. Correlation documentation must be maintained by the certificate holder.

[(e) All airplanes subject to this section are also subject to the requirements and exceptions stated in §§ 121.344(g) through 121.344(k) of this part.

deHavilland DHC–6, Dornier 228, HS–748, Embraer EMB 110, Jetstream 3101, Jetstream 3201, Fairchild Aircraft SA–226.]

[(Amdt. 121–266, Eff. 8/18/97)]

§ 121.345 Radio equipment.

(a) No person may operate an airplane unless it is equipped with radio equipment required for the kind of operation being conducted.

(b) Where two independent (separate and complete) radio systems are required by §§ 121.347 and 121.349, each system must have an independent antenna installation except that, where rigidly supported nonwire antennas or other antenna installations of equivalent reliability are used, only one antenna is required.

(c) ATC transponder equipment installed within the time periods indicated below must meet the performance and environmental requirements of the following TSOs—

(1) *Through January 1, 1992.*

(i) Any class of TSO–C74b or any class of TSO–C74c as appropriate, provided that the equipment was manufactured before January 1, 1990; or

(ii) The appropriate class of TSO–C112 (Mode S).

(2) *After January 1, 1992.* The appropriate class of TSO–C112 (Mode S). For purposes of paragraph (b)(2) of this section, ''installation'' does not include—

(i) Temporary installation of TSO–C74b or TSO–C74c substitute equipment, as appropriate, during maintenance of the permanent equipment;

(ii) Reinstallation of equipment after temporary removal for maintenance; or

(iii) For fleet operations, installation of equipment in a fleet aircraft after removal of the equipment for maintenance from another aircraft in the same operator's fleet.

(Amdt. 121–101, Eff. 1/26/73); (Amdt. 121–190, Eff. 4/6/87)

the following—

(1) Communicate with at least one appropriate ground station from any point on the route.

(2) [Communicate with appropriate traffic control facilities from any point within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport in which flights are intended.]

(3) Receive meteorological information from any point en route by either of two independent systems. One of the means provided to comply with this subparagraph may be used to comply with paragraphs (a)(1) and (2) of this section.

(b) No person may operate an airplane at night under VFR over routes that can be navigated by pilotage unless that airplane is equipped with the radio equipment necessary under normal operating conditions to fulfill the functions specified in paragraph (a) of this section and to receive radio navigational signals applicable to the route flown, except that a marker beacon receiver or ILS receiver is not required.

[(Amdt 121–226, Eff. 9/16/93)]

§ 121.349 Radio equipment for operations under VFR over routes not navigated by pilotage or for operations under IFR or over-the-top.

(a) No person may operate an airplane under VFR over routes that cannot be navigated by pilotage or for operations conducted under IFR or over-the-top, unless the airplane is equipped with that radio equipment necessary under normal operating conditions to fulfill the functions specified in § 121.347(a) and to receive satisfactorily by either of two independent systems, radio navigational signals from all primary en route and approach navigational facilities intended to be used. However, only one marker beacon receiver providing visual and aural signals and one ILS receiver need be provided. Equipment provided to receive signals en route may be used to receive signals on approach, if it is capable of receiving both signals.

(b) In the case of operation over routes on which navigation is based on low frequency radio range

a suitable airport, by means of VOR aids, and complete an instrument approach by use of the remaining airplane radio system.

(c) Whenever VOR navigational receivers are required by paragraph (a) or (b) of this section, at least one approved distance measuring equipment unit (DME) capable of receiving and indicating distance information from VORTAC facilities must be installed on each airplane when operated in the 50 states and the District of Columbia.

(d) If the distance measuring equipment (DME) becomes inoperative en route, the pilot shall notify ATC of that failure as soon as it occurs.

[(e) No person may operate an airplane having a passenger seat configuration of 10 to 30 seats, excluding each crewmember seat, and a payload of 7,500 pounds or less under IFR or in extended overwater operations unless it has, in addition to any other required radio communications and navigational equipment appropriate to the facilities to be used which are capable of transmitting to, and receiving from, at any place on the route to be flown, at least one ground facility, two microphones, and two headsets or one headset and one speaker.]

(Amdt. 121–1, Eff. 4/1/65); (Amdt. 121–19, Eff. 7/1/66); (Amdt. 121–130, Eff. 11/26/76); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.351 Radio equipment for extended over-water operations and for certain other operations.

(a) [Except as provided in paragraph (c) of this section, no person may conduct an extended overwater operation unless the airplane is equipped with the radio communication equipment necessary to comply with § 121.349, an independent system that complies with § 121.347(a)(1), and two long-range navigation systems when VOR or ADF radio navigation equipment is unusable along a portion of the route.]

(b) No certificate holder conducting a flag or supplemental operation or a domestic operation within the State of Alaska may conduct an operation without the equipment specified in paragraph (a) of this section, if the Administrator finds that equipment to be necessary for search and rescue ations and routes in certain geographic areas. The following are among the operational factors the Administrator may consider in granting an authorization: (1) the ability of the flightcrew to reliably fix the position of the airplane within the degree of accuracy required by ATC, (2) the length of the route being flown, and (3) the duration of the very high frequency communications gap.]

(Amdt. 121–253, Eff. 2/26/96); [(Amdt. 121–254, Eff. 2/26/96)]

§ 121.353 [Emergency equipment for operations over uninhabited terrain areas: Flag, supplemental, and certain domestic operations.

[Unless the airplane has the following equipment, no person may conduct a flag or supplemental operation or a domestic operation within the States of Alaska or Hawaii over an uninhabited area or any other area that (in its operations specifications) the Administrator specifies required equipment for search and rescue in case of an emergency:]

(a) Suitable pyrotechnic signaling devices.

(b) An approved survival type emergency locator transmitter. Batteries used in this transmitter must be replaced (or recharged, if the battery is rechargeable) when the transmitter has been in use for more than 1 cumulative hour, or, when 50 percent of their useful life (or for rechargeable batteries, 50 percent of their useful life of charge) has expired, as established by the transmitter manufacturer under its approval. The new expiration date for replacing (or recharging) the battery must be legibly marked on the outside of the transmitter. The battery useful life (or useful life of charge) requirements of this paragraph do not apply to batteries (such as water-activated batteries) that are essentially unaffected during probable storage intervals.

(c) Enough survival kits, appropriately equipped for the route to be flown, for the number of occupants of the airplane.

(Amdt. 121–79, Eff. 10/21/71); (Amdt. 121–106, Eff. 9/19/73); (Amdt. 121–158, Eff. 9/9/80); (Amdt. 121–239, Eff. 6/21/94); [(Amdt. 121–251, Eff. 1/19/96)]

the District of Columbia, unless such systems have been approved in accordance with appendix G to this part; or

(2) Using Doppler Radar or an Inertial Navigation System within the 48 contiguous States and the District of Columbia, or any other specialized means of navigation, unless it shows that an adequate airborne system is provided for the specialized navigation authorized for the particular operation.

(b) Notwithstanding paragraph (a) of this section, Doppler Radar and Inertial Navigation Systems, and the training programs, maintenance programs, relevant operations manual material, and minimum equipment lists prepared in accordance therewith, approved before April 29, 1972, are not required to be approved in accordance with that paragraph.

(Amdt. 121–89, Eff. 4/29/72)

§ 121.356 Traffic Alert and Collision Avoidance System.

(a) Unless otherwise authorized by the Administrator, each certificate holder operating a large airplane that has a passenger seating configuration, excluding any pilot seat, of more than 30 seats, shall equip its airplanes with an approved TCAS II traffic alert and collision avoidance system and the appropriate class of Mode S transponder according to the following schedule—

Date	*Required Equipage*
December 30, 1990	At least 20% of all covered airplanes, if the certificate holder operates more than 30 such airplanes.
December 30, 1991	50% of all covered airplane.
December 30, 1993	100% of all covered airplanes.

(b) Unless otherwise authorized by the Administrator, after December 31, 1995, no person may operate a passenger or combination cargo/passenger (combi) airplane that has a passenger seat configuration, excluding any pilot seat, of 10 to 30 seats unless it is equipped with an approved traffic alert and collision avoidance system. If a TCAS II system is installed, it must be capable of coordinating with TCAS units that meet TSO C–119.

the equipment.

(2) An outline of all input sources that must be operative for the TCAS to function properly.

Docket No. 25355 (54 FR 951) Eff. 1/10/89

(Amdt. 121–201, Eff. 2/9/89); (Amdt. 121–217, Eff. 5/9/90); (Amdt. 121–246, Eff. 12/29/94); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.357 Airborne weather radar equipment requirements.

(a) [No person may operate any transport category airplane (except C–46 type airplanes) or a nontransport category airplane certificated after December 31, 1964, unless approved airborne weather radar equipment has been installed in the airplane.]

(b) Reserved

(c) [Each person operating an airplane required to have approved airborne weather radar equipment installed shall, when using it under this part, operate it in accordance with the following:]

(1) *Dispatch.* No person may dispatch an airplane (or begin the flight of an airplane in the case of [a certificate holder] that does not use a dispatch system) under IFR or night VFR conditions when current weather reports indicate that thunderstorms, or other potentially hazardous weather conditions that can be detected with airborne weather radar, may reasonably be expected along the route to be flown, unless the airborne weather radar equipment is in satisfactory operating condition.

(2) If the airborne weather radar becomes inoperative en route, the airplane must be operated in accordance with the approved instructions and procedures specified in the operations manual for such an event.

(d) This section does not apply to airplanes used solely within the State of Hawaii or within the State of Alaska and that part of Canada west of longitude 130 degrees W, between latitude 70 degrees N, and latitude 53 degrees N, or during any training, test, or ferry flight.

(e) Notwithstanding any other provision To obtain approval of a retrofit schedule and of this

equipment requirements.

(a) *Airplanes manufactured after January 2, 1991.* No person may operate a turbine-powered airplane manufactured after January 2, 1991, unless it is equipped with either an approved airborne windshear warning and flight guidance system, an approved airborne detection and avoidance system, or an approved combination of these systems.

(b) *Airplanes manufactured before January 3, 1991.* Except as provided in paragraph (c) of this section, after January 2, 1991, no person may operate a turbine-powered airplane manufactured before January 3, 1991 unless it meets one of the following requirements as applicable.

(1) The makes/models/ series listed below must be equipped with either an approved airborne windshear warning and flight guidance system, an approved airborne detection and avoidance system, or an approved combination of these systems—

(i) A–300–600;

(ii) A–310–all series;

(iii) A–320–all series;

(iv) B–737–300, 400, and 500 series;

(v) 13–747–400;

(vi) 13–757–all series;

(vii) 13–767–all series;

(viii) F–100–all series;

(ix) MD–11–all series; and

(x) MD–80 series equipped with an EFIS and Honeywell–970 digital flight guidance computer.

(2) All other turbine-powered airplanes not listed above must be equipped with as a minimum requirement, an approved airborne windshear warning system. These airplanes may be equipped with an approved airborne windshear detection and avoidance system, or an approved combination of these systems.

(c) *Extension of the compliance date.* A certificate holder may obtain an extension of the compliance date in paragraph (b) of this section if it obtains FAA approval of a retrofit schedule. To obtain approval of a retrofit schedule and show continued compliance with that schedule, a certificate holder must do the following—

compliance date established for TCAS II retrofit.

(3) Comply with its retrofit schedule and submit status reports containing information acceptable to the Administrator. The initial report must be submitted by January 2, 1991, and subsequent reports must be submitted every six months thereafter until completion of the schedule. The reports must be submitted to the certificate holder's assigned Principal Avionics Inspector.

(d) *Definitions.* For the purposes of this section the following definitions apply—

(1) "Turbine-powered airplane" includes, e.g., turbofan-, turbojet-, propfan-, and ultrahigh bypass fan-powered airplanes. The definition specifically excludes turbopropeller-power airplanes.

(2) An airplane is considered manufactured on the date the inspection acceptance records reflect that the airplane is complete and meets the FAA Approved Type Design data.

(Amdt. 121–199, Eff. 1/2/89); (Amdt. 121–216, Eff. 4/9/90)

§ 121.359 Cockpit voice recorders.

(a) No certificate holder may operate a large turbine-engine-powered airplane or a large pressurized airplane with four reciprocating engines unless an approved cockpit voice recorder is installed in that airplane and is operated continuously from the start of the use of the checklist (before starting engines for the purpose of flight), to completion of the final checklist at the termination of the flight.

(b) [Reserved]

(c) [The cockpit voice recorder required by paragraph (a) of this section must meet the following application standards:]

(1) The requirements of part 25 of this chapter in effect on August 31, 1977.

(2) After September 1, 1980, each recorder container must—

(i) Be either bright orange or bright yellow;

(ii) Have reflective tape affixed to the external surface to facilitate its location under water; and

(iii) Have an approved underwater locating device on or adjacent to the container which

[(d) No person may operate a multiengine, turbine-powered airplane having a passenger seat configuration of 10–19 seats unless it is equipped with an approved cockpit voice recorder that:

(1) Is installed in compliance with § 23.1457(a)(1) and (2), (b), (c), (d), (e), (f), and (g); § 25.1457(a)(1) and (2), (b), (c), (d), (e), (f), and (g) of this chapter, as applicable; and

(2) Is operated continuously from the use of the checklist before the flight to completion of the final checklist at the end of the flight.

[(e) No person may operate a multiengine, turbine-powered airplane having a passenger seat configuration of 20 to 30 seats unless it is equipped with an approved cockpit voice recorder that—

(1) Is installed in compliance with § 23.1457 or § 25.1457 of this chapter, as applicable; and

(2) Is operated continuously from the use of the checklist before the flight to completion of the final checklist at the end of the flight.]

([f]) In complying with this section, an approved cockpit voice recorder having an erasure feature may(be used, so(that at any time during the operation of the recorder, information recorded more than 30 minutes earlier may be erased or otherwise obliterated.

([g]) For those aircraft equipped to record the uninterrupted audio signals received by a boom or a mask microphone, the flight crewmembers are required to use the boom microphone below 18,000 feet mean sea level. No person may operate a large turbine-engine-powered airplane or a large pressurized airplane with four reciprocating engines manufactured after October 11, 1991, or on which a cockpit voice recorder has been installed after October 11, 1991, unless it is equipped to record the uninterrupted audio signal received by a boom or mask microphone in accordance with § 25.1457(c)(5) of this chapter.

([h]) In the event of an accident or occurrence requiring immediate notification of the National Transportation Safety Board under part 830 of its regulations, which results in the termination of the flight, the certificate holder shall keep the recorded information for at least 60 days or, if requested by the Administrator or the Board, for a longer period. Information obtained from the record is used to assist in determining the cause of accidents or

197, Eff. 10/11/88); [(Amdt. 121–251, Eff. 1/19/96)]

§ 121.360 Ground proximity warning-glide slope deviation alerting system.

[(a) No person may operate a turbine-powered airplane unless it is equipped with a ground proximity warning system that meets the performance and environmental standards of TSO–C92 or incorporates TSO-approved ground proximity warning equipment.

[(b) For the ground proximity warning system required by this section, the Airplane Flight Manual shall contain—

(1) Appropriate procedures for—

(i) The use of the equipment;

(ii) Proper flightcrew action with respect to the equipment;

(iii) Deactivation for planned abnormal and emergency conditions;

(iv) Inhibition of Mode 4 warnings based on flaps being in other than the landing configuration if the system incorporates a Mode 4 flap warning inhibition control; and

(2) An outline of all input sources that must be operating.

[(c) No person may deactivate a ground proximity warning system required by this section except in accordance with the procedures contained in the Airplane Flight Manual.

[(d) Whenever a ground proximity warning system required by this section is deactivated, an entry shall be made in the airplane maintenance record that includes the date and time of deactivation.

[(e) No person may operate a turbine-powered airplane unless it is equipped with a ground proximity warning/glide slope deviation alerting system that meets the performance and environmental standards contained in TSO–C92a or TSO–C92b or incorporates TSO-approved ground proximity warning-glide slope deviation alerting equipment.

[(f) No person may operate a turbojet-powered airplane equipped with a system required by paragraph (e) of this section, that incorporates equipment that meets the performance and environmental standards of TSO–C92b or is approved under that

[The recorded values must meet the designated range, resolution, and accuracy requirements during dynamic and static conditions. All data recorded must be correlated in time to within one second.

Parameters	*Range*	*Accuracy (sensor input)*	*Seconds per sampling interval*	*Resolution*	*Remarks*
1. Time or Relative Times Counts	24 Hrs, 0 to 4095	+/−0.125% Per Hour	4	1 sec	UTC time preferred when available. Counter increments each 4 seconds of system operation.
2. Pressure Altitude	−1000 ft to max certificated altitude of aircraft. +5000 ft	+/−100 to +/−700 ft (see table, TSO C124a or TSO C51a)	1	5′ to 35′	Data should be obtained from the air data computer when practicable.
3. Indicated airspeed or Calibrated airspeed	50 KIAS or minimum value to Max V_{so} and V_{so} to 1.2 V_D	+/−5% and +/−3%	1	1 kt	Data should be obtained from the air data computer when practicable.
4. Heading (Primary flight crew reference)	0–360° and Discrete "true" or "mag"	+/−2°	1	0.5°	When true or magnetic heading can be selected as the primary heading reference, a discrete indicating selection must be recorded.
5. Normal Acceleration (Vertical)	−3g to +6g	+/−1% of max range excluding datum error of +/−5%	0.125	0.004g	
6. Pitch Attitude	+/−75°	+/−2°	1 or 0.25 for airplanes operated under § 121.344(f)	0.5°	A sampling rate of 0.25 is recommended.
7. Roll Attitude	+/−180°	+/−2°	1 or 0.5 for airplanes operated under § 121.344(f)	0.5°	A sampling rate of 0.5 is recommended.

chronization reference					provided the CVR/FDR system complies with TSO C124a CVR synchronization requirements (paragraph 4.2.1 ED–55).
9. Thrust/Power on Each Engine—primary flight crew reference	Full Range Forward	+/−2%	1 (per engine)	0.2% of full range	Sufficient parameters (e.g. EPR, N1 or Torque, NP) as appropriate to the particular engine be recorded to determine power in forward and reverse thrust, including potential overspeed conditions.
10. Autopilot Engagement	Discrete "on" or "off"		1		
11. Longitudinal Acceleration	+/−1g	+/−1.5% max. range excluding datum error of +/−5%	0.25	0.004g	
12a. Pitch Control(s) position (non-fly-by-wire systems)	Full Range	+/−2% Unless Higher Accuracy Uniquely Required	0.5 or 0.25 for airplanes operated under § 121.344(f)	0.2% of full range	For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5 or 0.25, as applicable.
12b. Pitch Control(s) position (fly-by-wire systems)	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5 or 0.25 for airplanes operated under § 121.344(f)	0.2% of full range	
13a. Lateral Control position(s) (non-fly-by-wire)	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5 or 0.25 for airplanes operated under § 121.344(f)	0.2% of full range	For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5 or 0.25, as applicable.

14a. Yaw Control position(s) (non-fly-by-wire)	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5	0.2% of full range	For airplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5.
14b. Yaw Control position(s) (fly-by-wire)	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5	0.2% of full range	
15. Pitch Control Surface(s) Position	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5 or 0.25 for airplanes operated under § 121.344(f)	0.2% of full range	For airplanes fitted with multiple or split surfaces, a suitable combination of inputs is acceptable in lieu or recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5 or 0.25.
16. Lateral Control Surface(s) Position	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5 or 0.25 for airplanes operated under § 121.344(f)	0.2% of full range	A suitable combination of surface position sensors is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5 or 0.25.
17. Yaw Control Surface(s) Position	Full Range	+/−2° Unless Higher Accuracy Uniquely Required	0.5	0.2% of full range	For airplanes with multiple or split surfaces, a suitable combination of surface position sensors is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5.
18. Lateral Acceleration	+/−lg	+/−1.5% max. range excluding datum error of +/−5%	0.25	0.004g	

		Required			
20. Trailing Edge Flap or Cockpit Control Selection	Full Range or Each Position (discrete)	+/−3° or as Pilot's indicator	2	0.5% of full range	Flap position and cockpit control may each be sampled alternately at 4 second intervals, to give a data point every 2 seconds.
21. Leading Edge Flap or Cockpit Control Selection	Full Range or Each Discrete Position	+/−3° or as Pilot's indicator and sufficient to determine each discrete position	2	0.5% of full range	Left and right sides, or flap position and cockpit control may each be sampled at 4 second intervals, so as to give a data point every 2 seconds.
22. Each Thrust Reverser Position (or equivalent for propeller airplane)	Stowed, In Transit, and Reverse (Discrete)		1 (per engine)		Turbo-jet—2 discretes enable the 3 states to be determined. Turbo-prop—discrete.
23. Ground Spoiler Position or Speed Brake Selection	Full Range or Each Position (discrete)	+/−2° Unless Higher Accuracy Uniquely Required	1 or 0.5 for airplanes operated under § 121.344(f)	0.2% of full range	
24. Outside Air Temperature or Total Air Temperature	−50°C to +90°C	+/−2°C	2	0.3°C	
25. Autopilot/ Autothrottle/AFCS Mode and Engagement Status	A suitable combination of discretes		1		Discretes should show which systems are engaged and which primary modes are controlling the flight path and speed of the aircraft.
26. Radio Altitude	−20 ft to 2,500 ft	+/−2 ft or +/−3% Whichever is Greater Below 500 ft and +/−5% Above 500 ft	1	1 ft + 5% above 500 ft	For autoland/category 3 operations. Each radio altimeter should be recorded, but arranged so that at least one is recorded each second.
27. Localizer Deviation, MLS Azimuth, or GPS Latitude Deviation	+/−400 Microamps or available sensor range as installed +/−62°	As installed +/−3% recommended	1	0.3% of full range	For autoland/category 3 operations. Each system should be recorded but arranged so that at least one is recorded each second. It is not necessary to record ILS and MLS at the same time, only the approach aid in use need be recorded.

	stalled 0.9 to +30°				is recorded each second. It is not necessary to record ILS and MLS at the same time, only the approach aid in use need be recorded.
29. Marker Beacon Passage	Discrete "on" or "off"		1		A single discrete is acceptable for all markers.
30. Master Warning	Discrete		1		Record the master warning and record each "red" warning that cannot be determined from other parameters or from the cockpit voice recorder.
31. Air/ground sensor (primary airplane system reference nose or main gear)	Discrete "air" or "ground"		1 (0.25 recommended)		
32. Angle of Attack (If measured directly)	As installed	As installed	2 or 0.5 for airplanes operated under § 121.344(f)	0.3% of full range	If left and right sensors are available, each may be recorded at 4 or 1 second intervals, as appropriate, so as to give a data point at 2 seconds or 0.5 second, as required.
33. Hydraulic Pressure Low, Each System	Discrete or available sensor range, "low" or "normal"	+/−5%	2	0.5% of full range	
34. Groundspeed	As Installed	Most Accurate Systems Installed	1	0.2% of full range	
35. GPWS (ground proximity warning system)	Discrete "warning" or "off"		1		A suitable combination of discretes unless recorder capacity is limited in which case a single discrete for all modes is acceptable.
36. Landing Gear Position or Landing gear cockpit control selection	Discrete		4		A suitable combination of discretes should be recorded.
37. Drift Angle	As installed	As installed	4	0.1°	

39. Latitude and Longitude	As installed	As installed	1	0.002°, or as installed	Provided by the Primary Navigation System Reference. Where capacity permits Latitude/longitude resolution should be 0.0002°.
40. Stick shaker and pusher activation	Discrete(s) "on" or "off"		1		A suitable combination of discretes to determine activation.
41. Windshear Detection	Discrete "warning" or "off"		1		
42. Throttle/power lever position	Full Range	+/−2%	1 for each lever	2% of full range	For airplanes with non-mechanically linked cockpit engine controls.
43. Additional Engine Parameters	As installed	As installed	Each engine each second	2% of full range	Where capacity permits, the preferred priority is indicated vibration level, N2, EGT, Fuel Flow, Fuel Cutoff lever position and N3, unless engine manufacturer recommends otherwise.
44. Traffic Alert and Collision Avoidance System (TCAS)	Discretes	As installed	1		A suitable combination of discretes should be recorded to determine the status of—Combined Control, Vertical Control, Up Advisory, and Down Advisory. (ref. ARINC Characteristic 735 Attachment 6E, TCAS VERTICAL RA DATA OUTPUT WORD.)
45. DME 1 and 2 Distance	0–200 NM	As installed	4	1 NM	1 mile
46. Nav 1 and 2 Selected Frequency	Full Range	As installed	4		Sufficient to determine selected frequency
47. Selected barometric setting	Full Range	+/−5%	(1 per 64 sec.)	0.2% of full range	
48. Selected Altitude	Full Range	+/−5%	1	100 ft	
49. Selected speed	Full Range	+/−5%	1	1 knot	
50. Selected Mach	Full Range	+/−5%	1	.01	
51. Selected vertical speed	Full Range	+/−5%	1	100 ft/min	

54. Selected decision height	Full Range	+/−5%	64	1 ft	
55. EFIS display format	Discrete(s)		4		Discretes should show the display system status (e.g., off, normal, fail, composite, sector, plan, nav aids, weather radar, range, copy.
56. Multi-function/ Engine Alerts Display format	Discrete(s)		4		Discretes should show the display system status (e.g., off, normal, fail, and the identity of display pages for emergency procedures, need not be recorded.
57. Thrust command	Full Range	+/−2%	2	2% of full range	
58. Thrust target	Full Range	+/−2%	4	2% of full range	
59. Fuel quantity in CG trim tank	Full Range	+/−5%	(1 per 64 sec.)	1% of full range	
60. Primary Navigation System Reference	Discrete GPS, INS, VOR/ DME, MLS, Loran C, Omega, Localizer Glideslope		4		A suitable combination of discretes to determine the Primary Navigation System reference.
61. Ice Detection	Discrete "ice" or "no ice"		4		
62. Engine warning each engine vibration	Discrete		1		
63. Engine warning each engine over temp	Discrete		1		
64. Engine warning each engine oil pressure low	Discrete		1		
65. Engine warning each engine over speed	Discrete		1		

		Required			
67. Roll Trim Surface Position	Full Range	+/−3% Unless Higher Accuracy Uniquely Required	2	0.3% of full range	
68. Brake Pressure (left and right)	As installed	+/−5%	1		To determine braking effort applied by pilots or by autobrakes.
69. Brake Pedal Application (left and right)	Discrete or Analog "applied" or "off"	+/−5% (Analog)	1		To determine braking applied by pilots.
70. Yaw or sideslip angle	Full Range	+/−5%	1	0.5°	
71. Engine bleed valve position	Discrete "open" or "closed"		4		
72. De-icing or anti-icing system selection	Discrete "on" or "off"		4		
73. Computed center of gravity	Full Range	+/−5%	(1 per 64 sec.)	1% of full range	
74. AC electrical bus status	Discrete "power" or "off"		4		Each bus.
75. DC electrical bus status	Discrete "power" or "off"		4		Each bus.
76 APU bleed valve position	Discrete "open" or "closed"		4		
77. Hydraulic Pressure (each system)	Full range	+/−5%	2	100 psi	
78. Loss of cabin pressure	Discrete "loss" or "normal"		1		
79. Computer failure (critical flight and engine control systems)	Discrete "fail" or "normal"		4		

81. Para-visual display (when an information source is installed)	Discrete(s) "on" or "off"				
82. Cockpit trim control input position—pitch	Full Range	+/−5%	1	0.2% of full range	Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded.
83. Cockpit trim control input position—roll	Full Range	+/−5%	1	0.2% of full range	Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded.
84. Cockpit trim control input position—yaw	Full Range	+/−5%	1	0.2% of full range	Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded.
85. Trailing edge flap and cockpit flap control position	Full Range	+/−5%	2	0.5% of full range	Trailing edge flaps and cockpit flap control position may each be sampled alternately at 4 second intervals to provide a sample each 0.5 second.
86. Leading edge flap and cockpit flap control position	Full Range or Discrete	+/−5%	1	0.5% of full range	
87. Ground spoiler position and speed brake selection	Full Range or Discrete	+/−5%	0.5	0.2% of full range	

pedal)	umn +/−85 lbs Rudder pedal +/−165 lbs				of the control input device only, it is not necessary to record this parameter. For airplanes that have a flight control break away capability that allows either pilot to operate the control independently, record both control force inputs. The control force inputs may be sampled alternately once per 2 seconds to produce the sampling interval of 1.]

[(Amdt. 121–266, 8/18/97)]